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VOLUME V

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FINAL ENVIRONMENTAL IMPACT STATEMENT

Eastern Powder River Coal Basin of Wyoming



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APPENDIX A

Study Area Maps

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This is Volume V. It contains the appendices made up of maps, glossary, bibliography and supporting data for all parts of the environmental statement.

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	<u>Chapters V - XI.</u> Probable Impacts, Mitigating Measures, Unavoidable Adverse Effects, Alternatives, Relationships Between Short and Long Term Uses, Irreversible Commitments and Coordination	Vol. II
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Part III:	Proposed mining and reclamation by Atlantic Richfield Company	Vol. III
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VOLUME V

APPENDICES: MAPS, GLOSSARY, SELECTED BIBLIOGRAPHY, SUPPORTING DATA FOR ALL PARTS

Appendix

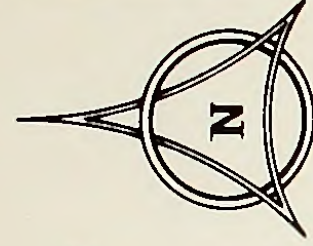
A. Study area maps that are referred to throughout the text.

Map Number

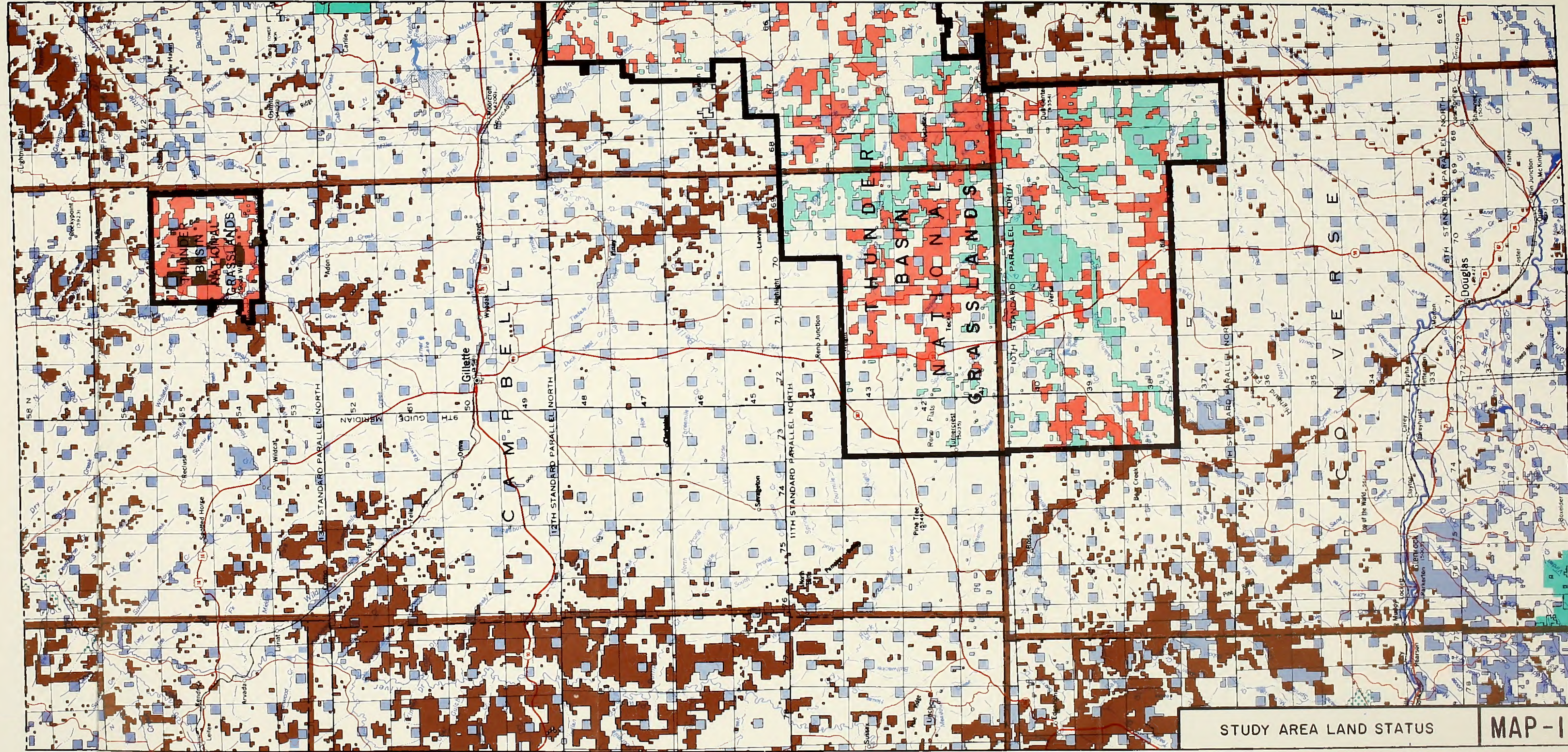
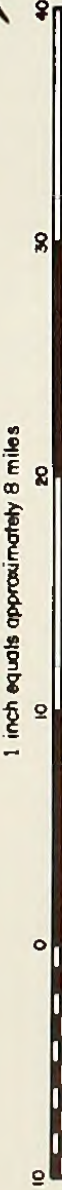
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3 . . .	Specific Applications and Proposed Future Actions	
4 . . .	Energy Resources of the Eastern Powder River Coal Basin	
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LEGEND

- Private Lands
- State Lands
- National Resource Lands
- Bureau of Reclamation Withdrawals
- National Forests
- Bankhead - Jones L.U. Lands
- Thunder Basin National Grasslands
- County Boundaries



Scale 1:500,000
1 inch equals approximately 8 miles



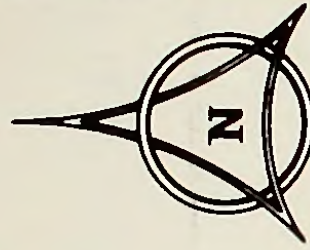
STUDY AREA LAND STATUS

MAP-1

LEGEND

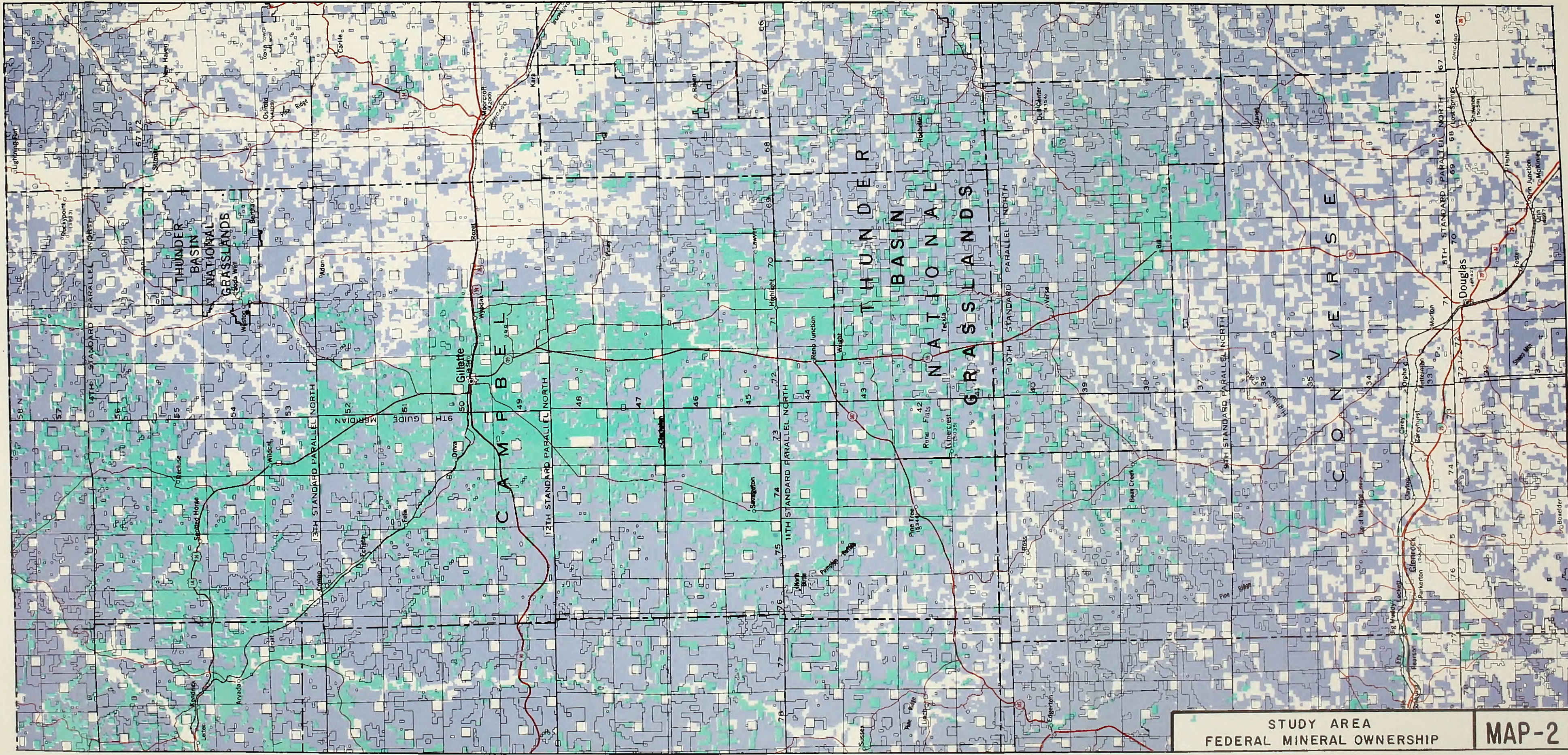
All Federal Mineral Ownerships

Partial Federal Mineral Ownerships





Scale 1:500,000







1 inch equals approximately 8 miles



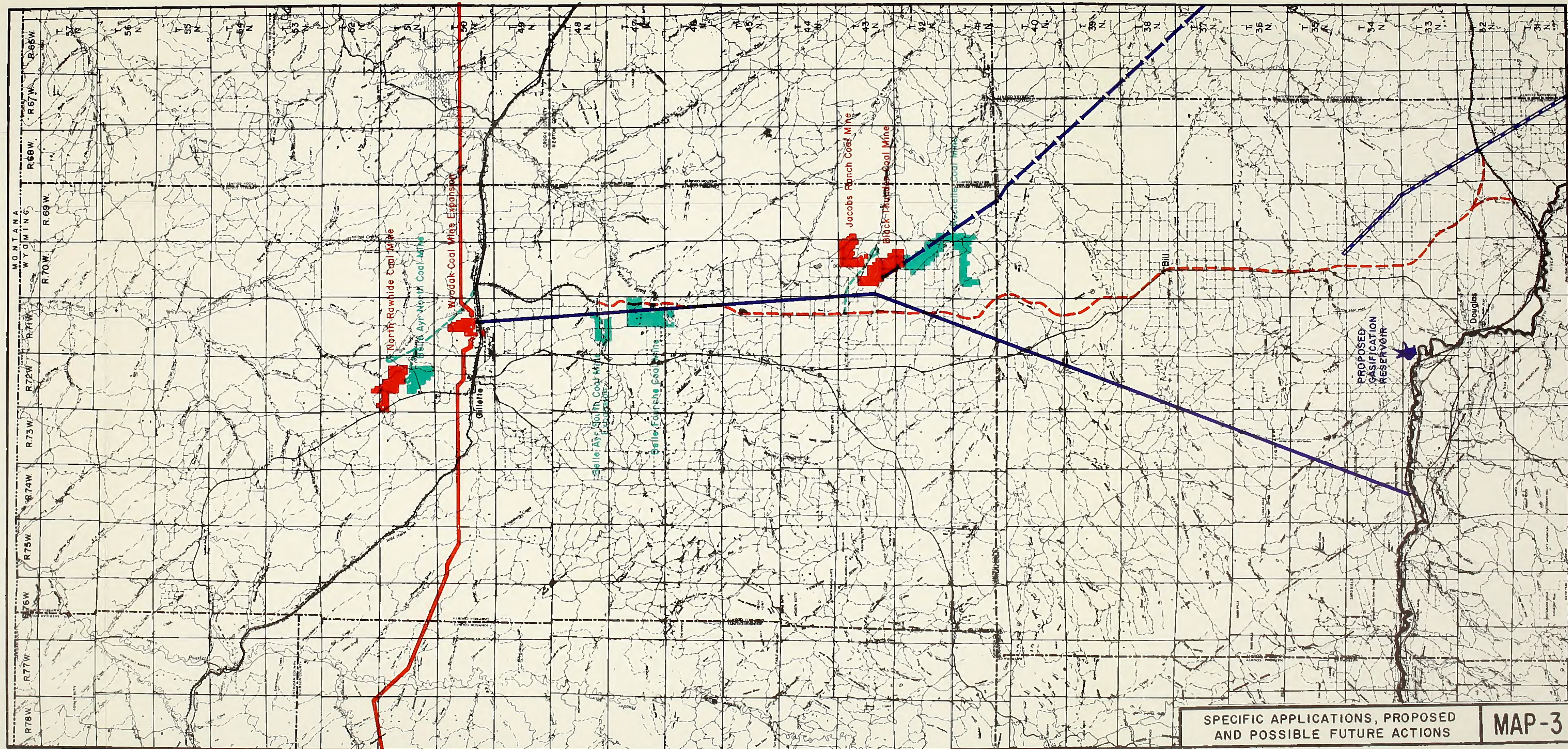
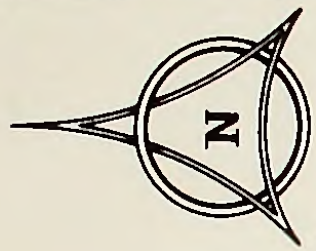
LEGEND

LEGEND

 Specific Applications
 Proposed Future Actions
 Possible Future Actions

 Existing Railroad Line
 Slurry Pipeline
 Railroad Line
 Gasification Pipeline
 Powerline
 Gasification Reservoir

Scale 1:500,000
 1 inch equals approximately 8 miles



SPECIFIC APPLICATIONS, PROPOSED AND POSSIBLE FUTURE ACTIONS

MAP-3

LEGEND

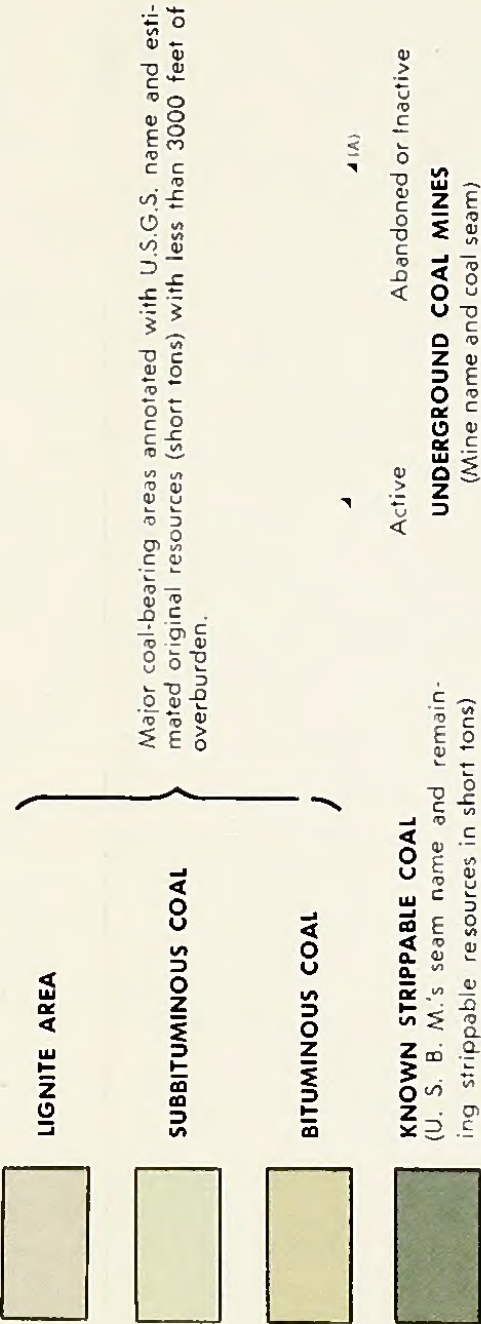
PETROLEUM AND NATURAL GAS



OIL SHALE

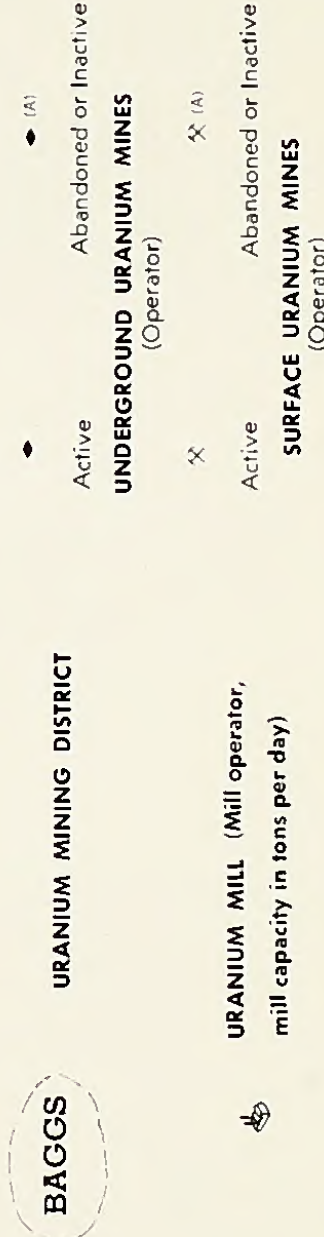


COAL

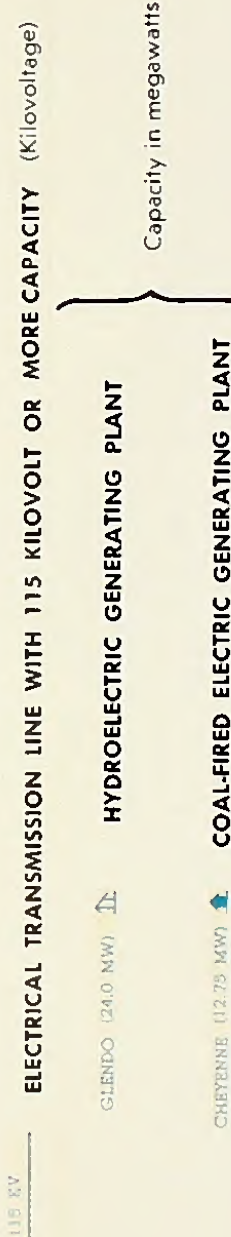


GEOLOGIC CONTACT BETWEEN TERTIARY AND CRETACEOUS ROCKS

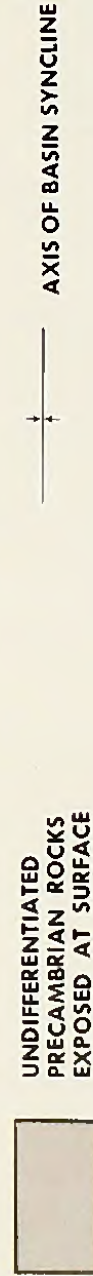
URANIUM



ELECTRICITY



GEOLOGY



COMPILED BY DONALD W. LANE, FORREST K. ROOT, AND GARY B. GLASS

THE GEOLOGICAL SURVEY OF WYOMING

SCALE 1:500,000

1 inch equals approximately 8 miles



For detailed information regarding mines and minerals shown on this map see—"Mineral Resources of Wyoming", Bulletin 50 (1966). The Geological Survey of Wyoming, Laramie; and the latest "Wyoming Minerals Yearbook", Department of Economic Planning and Development, Cheyenne. For similar information on petroleum and natural gas contact the State Oil and Gas Supervisor, Casper.

LEGEND

Geology

1. Alluvial deposits
2. Sandstone
3. Limestone
4. Shale
5. Clay
6. Gypsum
7. Salt
8. Other

1. Alluvial deposits

2. Sandstone

3. Limestone

4. Shale

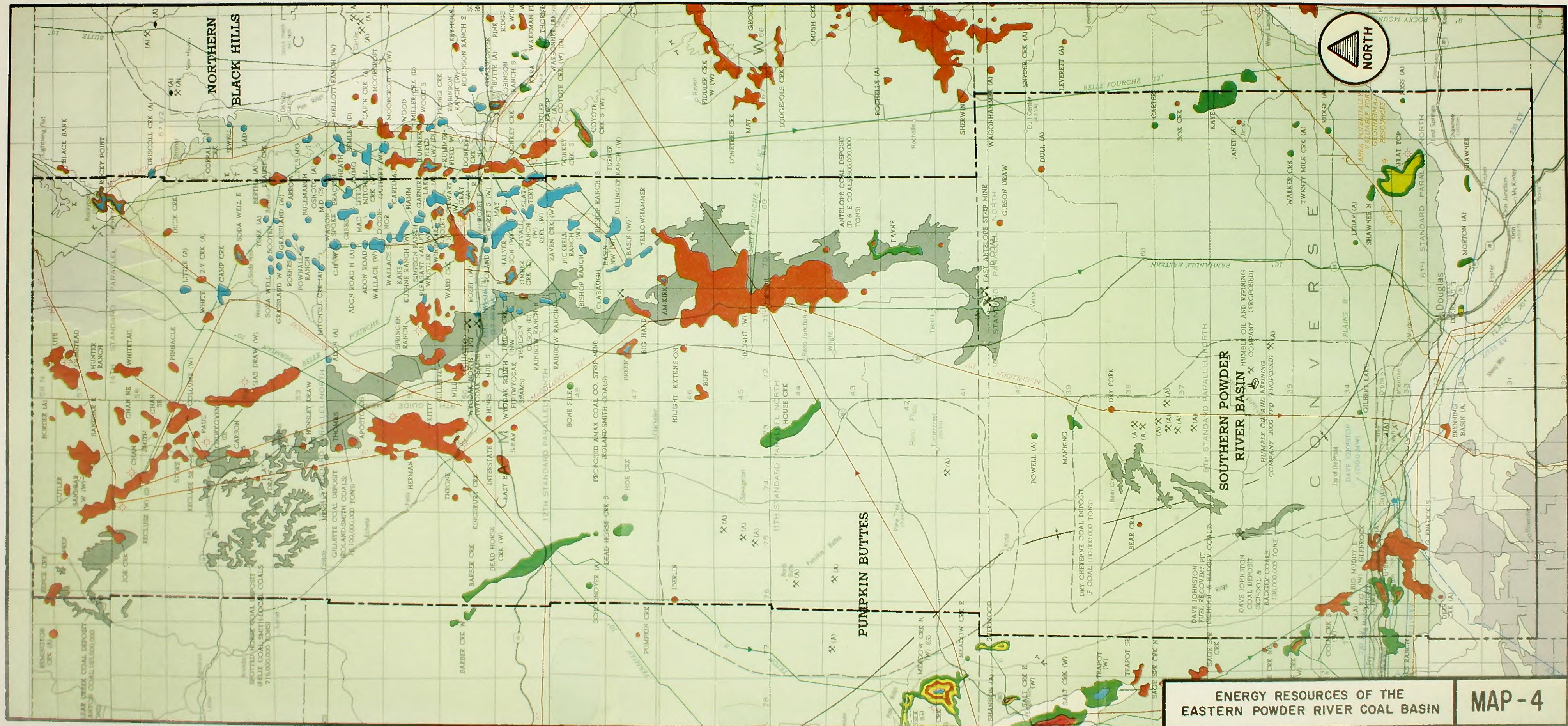
5. Clay

6. Gypsum

7. Salt

8. Other

9. Water



LEGEND



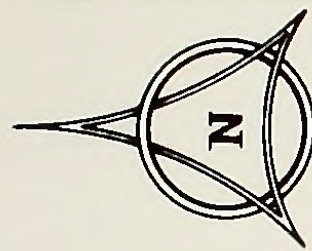
Federal Lease



Federal Prospecting Permit

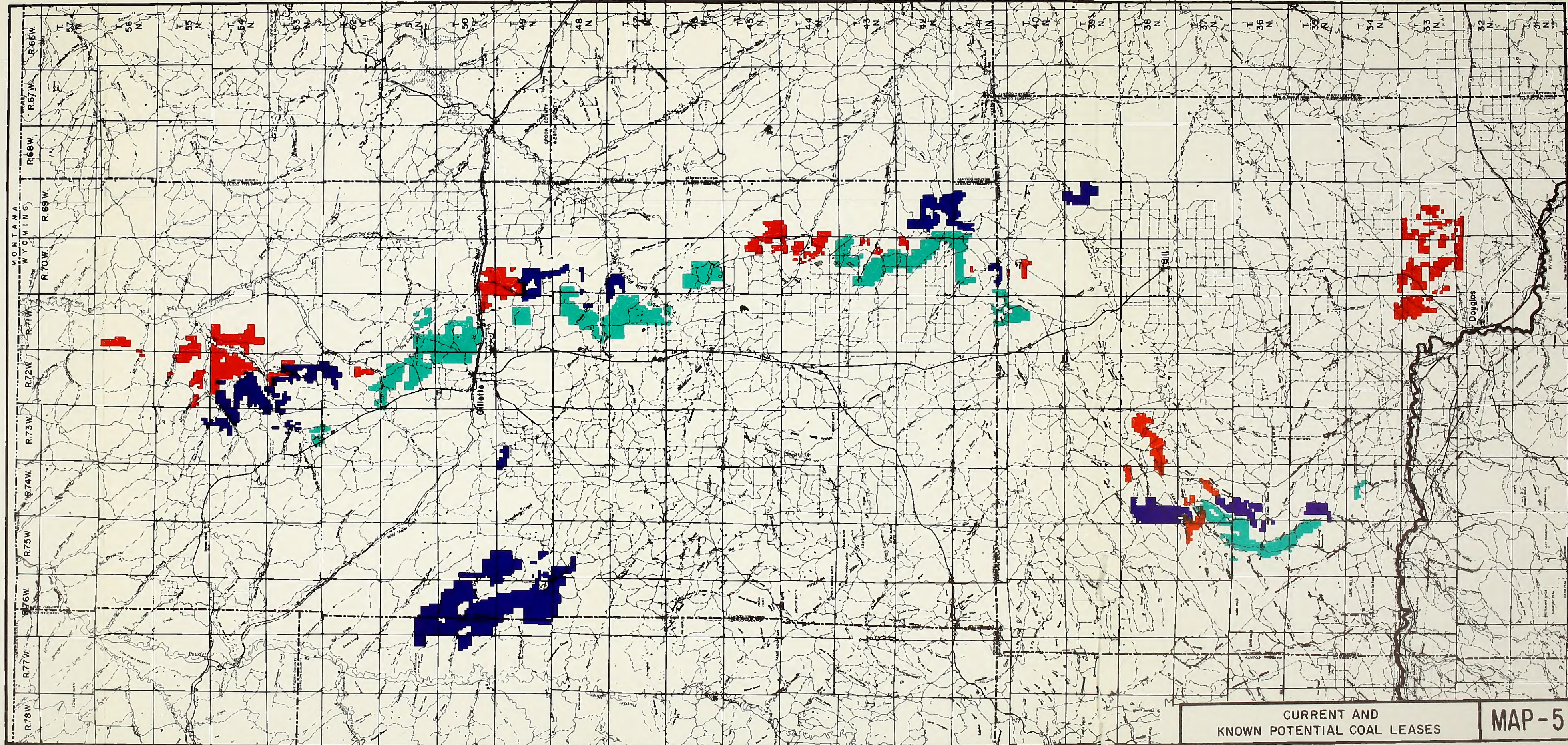


Pending Preference Right Leases



Scale 1:500,000

1 inch equals approximately 8 miles



CURRENT AND
KNOWN POTENTIAL COAL LEASES

MAP-5

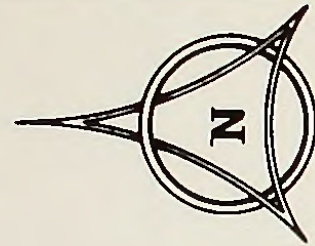
LEGEND

1000 Permanent Employees

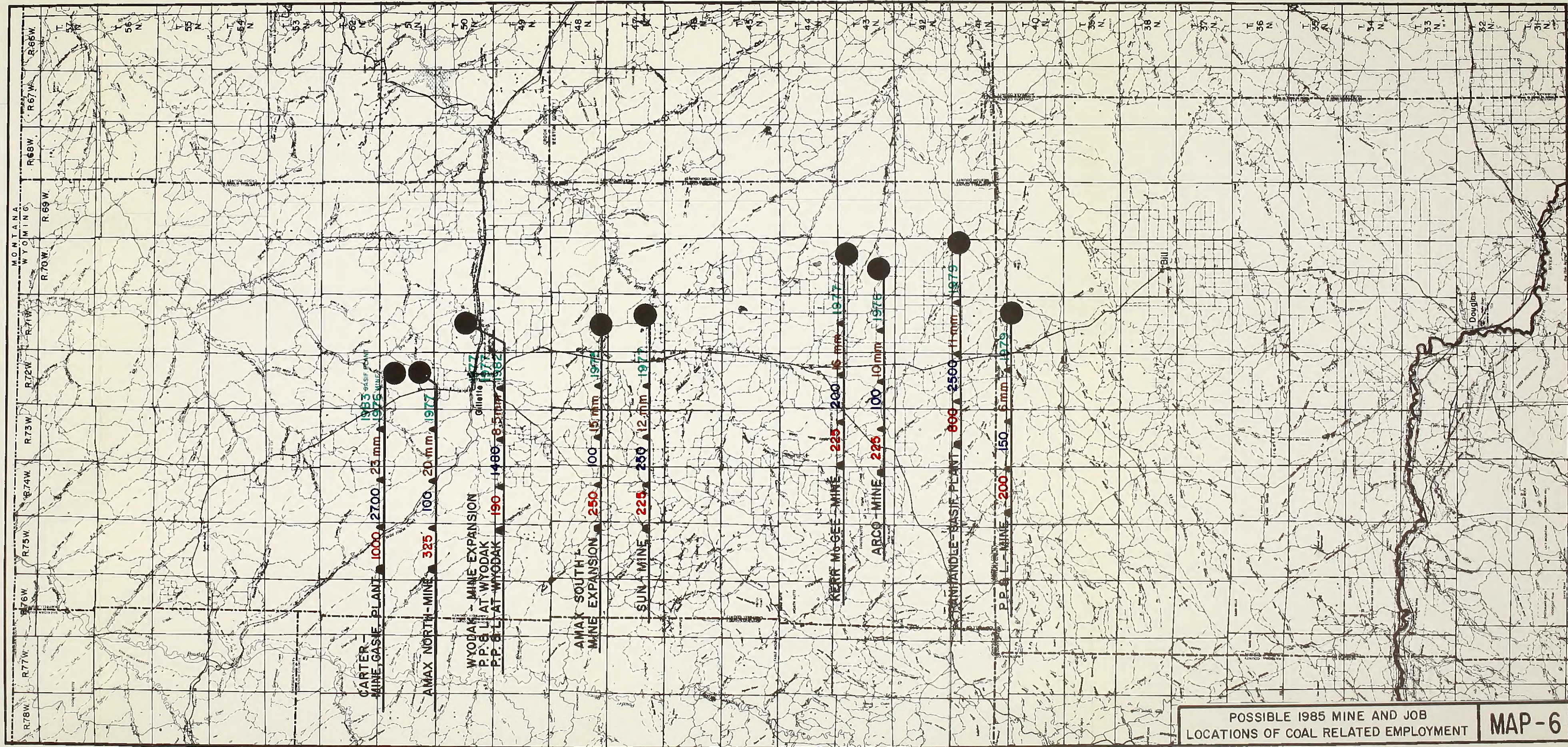
2500 Construction Employees

16 mm Maximum Projected Output or Consumption in Million Tons

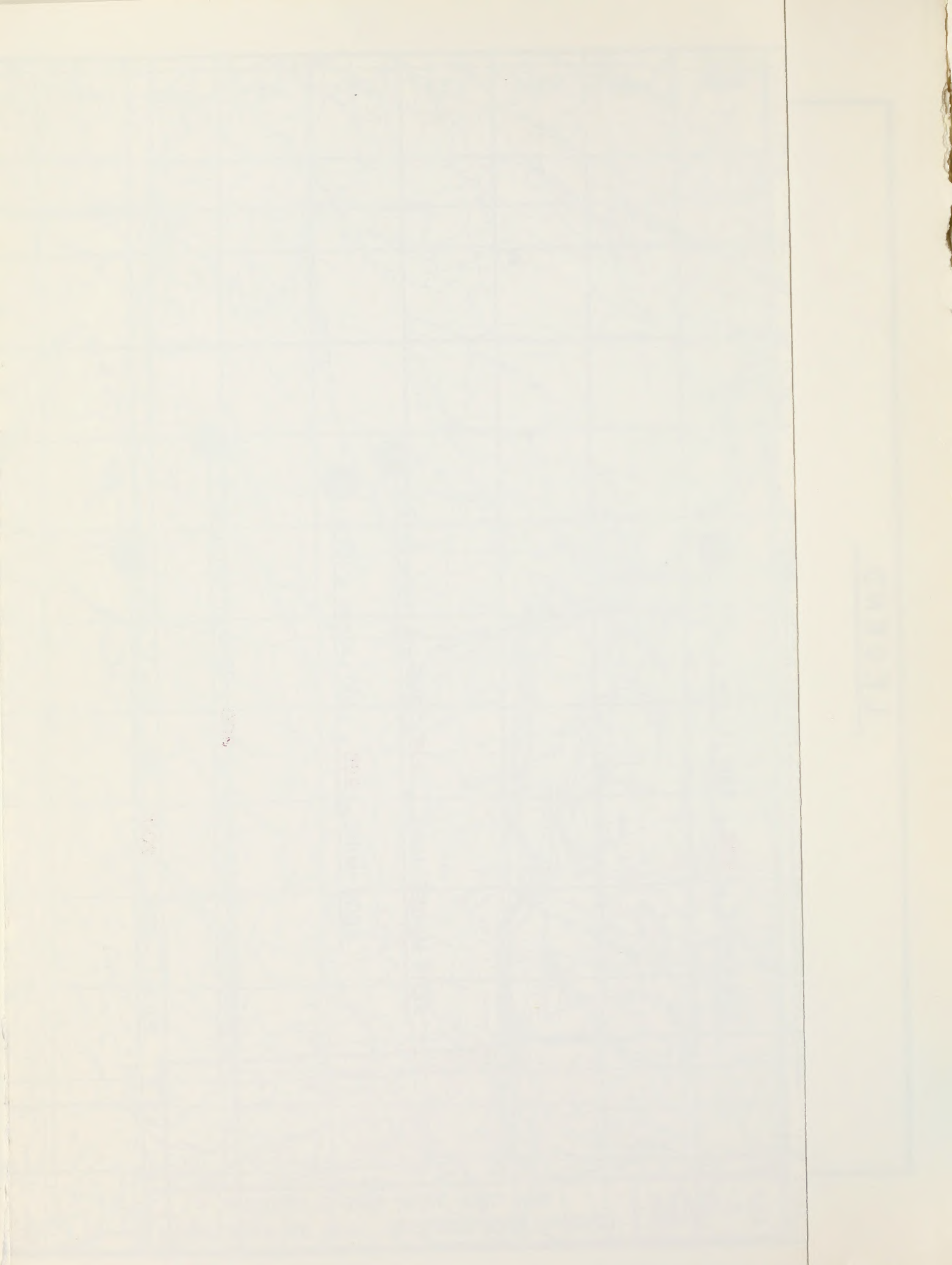
1979 Initial Year of Commencement



Scale 1:500,000
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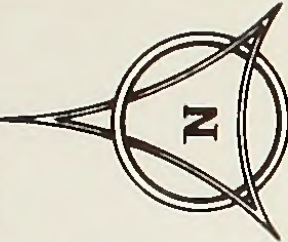
POSSIBLE 1985 MINE AND JOB LOCATIONS OF COAL RELATED EMPLOYMENT



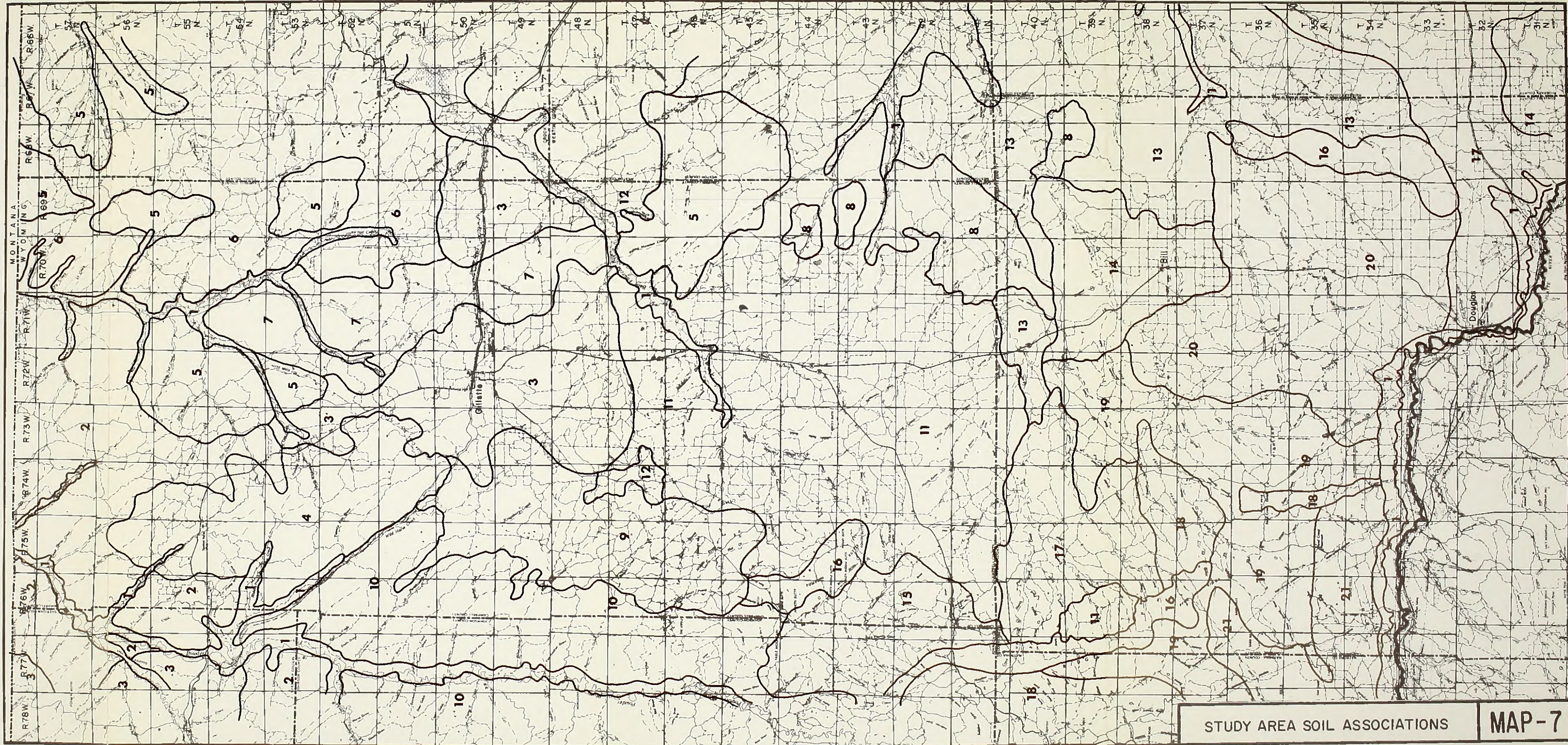
LEGEND

- | | |
|---|--|
| 1 Bankard-Haverson-Kim-Riverwash Association | 14 Arvada-Bone-Briggsdale-Maysdorf-Ulm Association |
| 2 Razor-Shingle Association | 15 Renohill-Pugsley-Briggsdale-Ulm Association |
| 3 Renohill-Maysdorf-Ulm Association | 16 Renohill-Briggsdale-Ulm-Tassel-Rockland Association |
| 4 Unnamed Association | 17 Shingle-Tassel-Dwyer-Mitchell-Trelona Association |
| 5 Renohill-Terry-Shingle Association | 18 Dwyer-Tassel-Terry Association |
| 6 Renohill-Wyarno-Cushman Association | 19 Rauzi-Recluse-Arvada Association |
| 7 Wibaux Association | 20 Tassel-Shingle-Otero-Terry-Olney-Kim Association |
| 8 Renohill-Wibaux-Tassel-Shingle-Rockland Association | 21 Valent-Dwyer-Duneland Association |
| 9 Renohill-Cushman Association | |
| 10 Renohill-Shinle-Terry Association | |
| 11 Renohill-Briggsdale-Ulm Association | |
| 12 Terry Association | |
| 13 Shingle-Kim-Shale-Rock Outcrop Association | |

Source: U.S.D.A., SCS, General Soil Maps of Converse and Campbell Counties, Wyo.



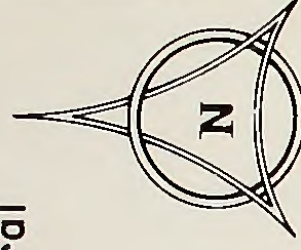
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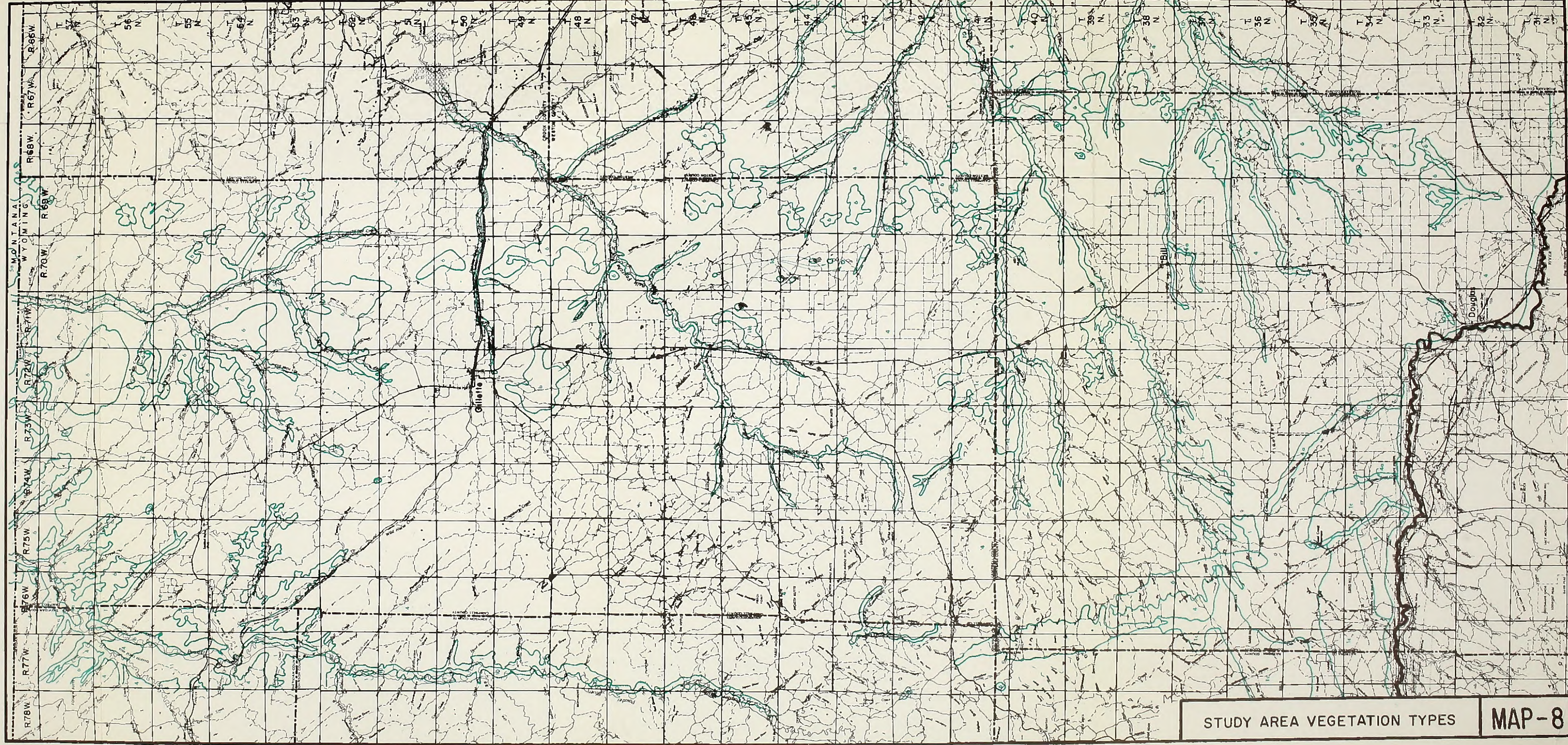
LEGEND

- 1 - Dry grassland (Agsm-Dist) 5 - Greasewood (Save)
- 1a - Playa grassland (Agsm) 5a - Saltbush (Atga)
- 1b - Scoria grassland (Agsp) 6 - Ponderosa pine forest (Pipo)
- 1c - Sandhills grassland (Cavi) 10 - Broadleaf forest (Posa)
- 2 - Wet meadow (Carex)
- 4 - Big sagebrush (Artr)
- 4a - Silver sagebrush (Arca)

Source: Compiled from
vegetation data of
various federal
agencies.



Scale 1:500,000
1 inch equals approximately 8 miles

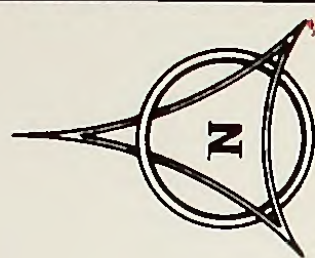


STUDY AREA VEGETATION TYPES

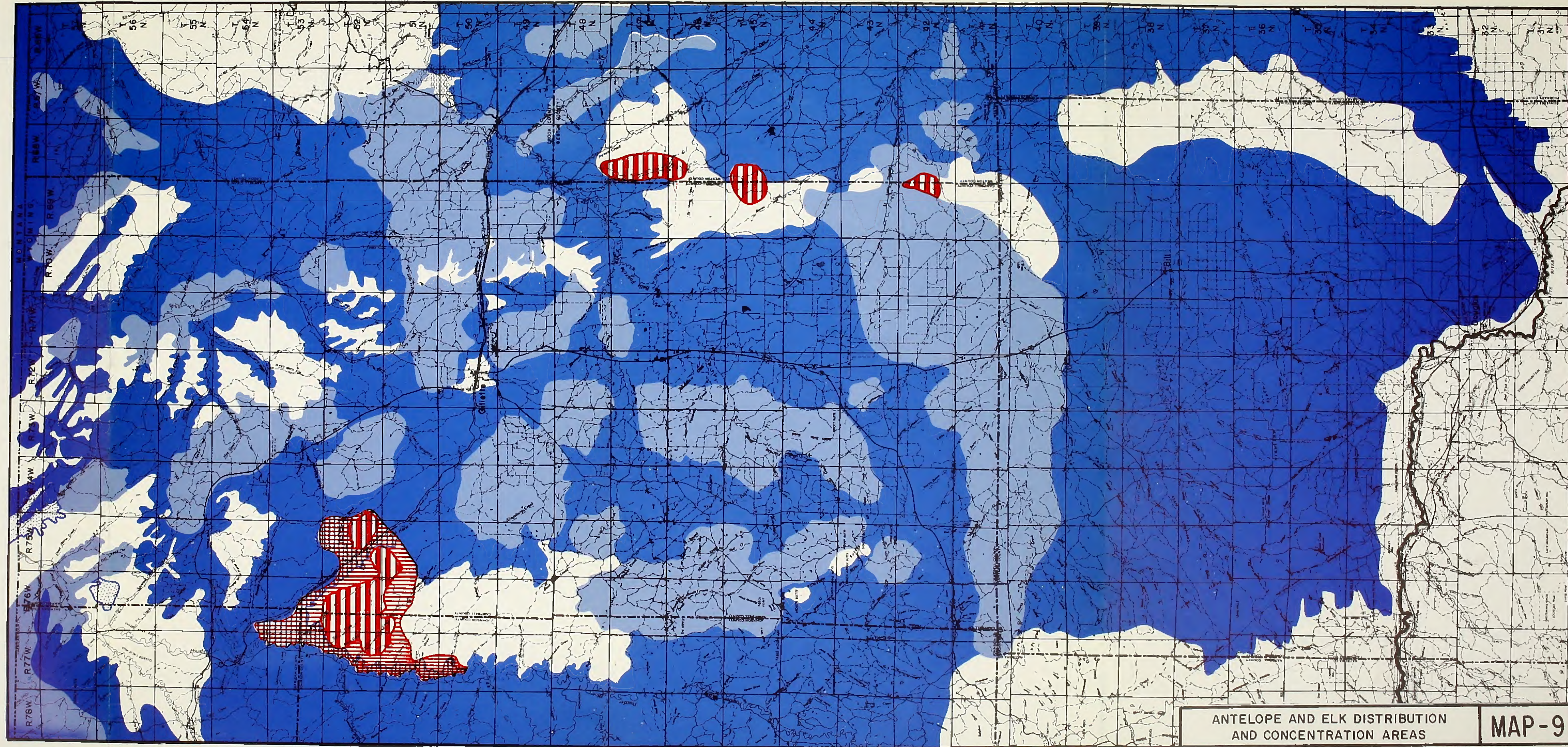
MAP-8

LEGEND

- Antelope Winter Concentration Areas
- Other Important Antelope Range
- Antelope Summer Range
- "Out" Areas (no antelope or very low populations)
- Key Elk Range
- Other Important Elk Range



Scale 1:500,000
1 inch equals approximately 8 miles



ANTELOPE AND ELK DISTRIBUTION AND CONCENTRATION AREAS

LEGEND



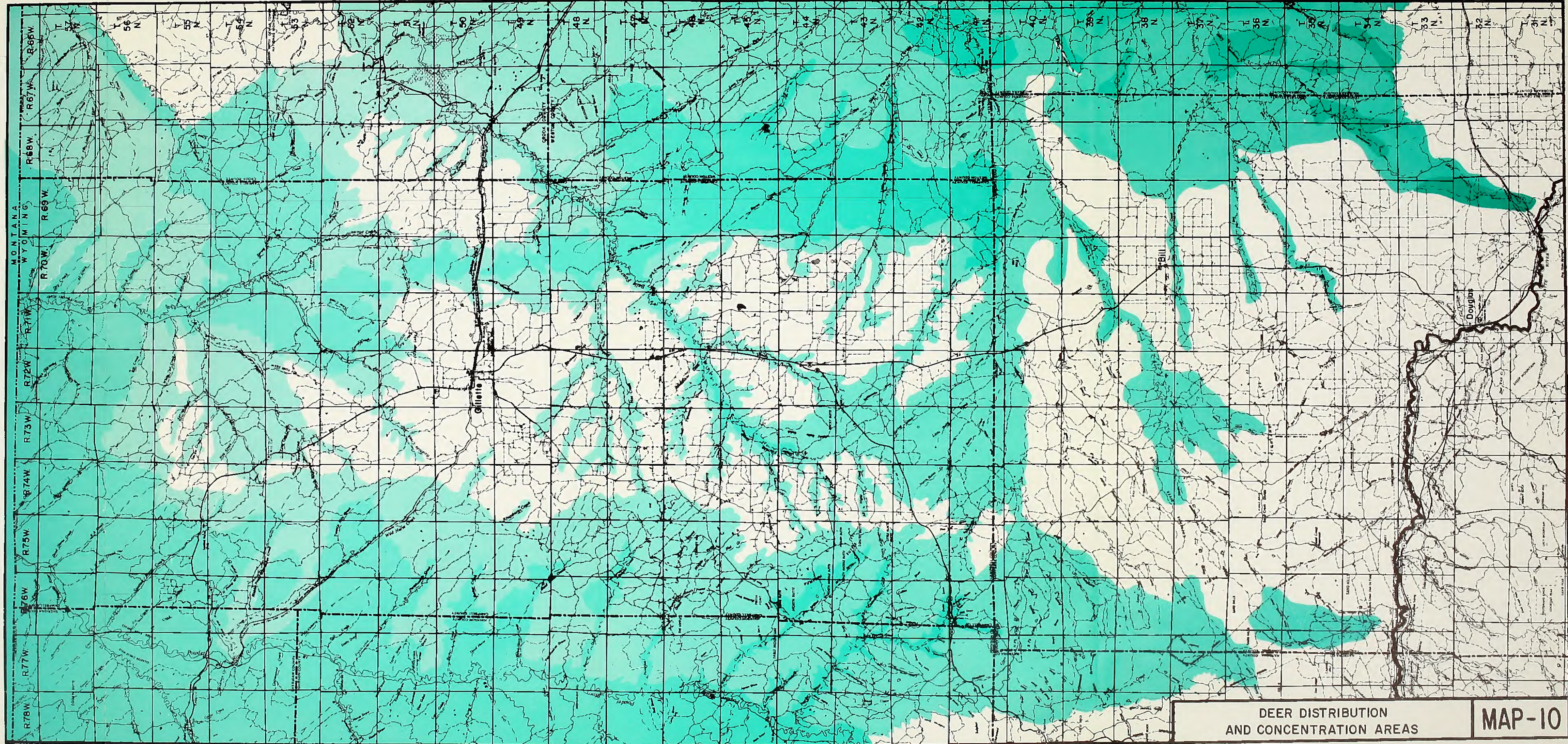
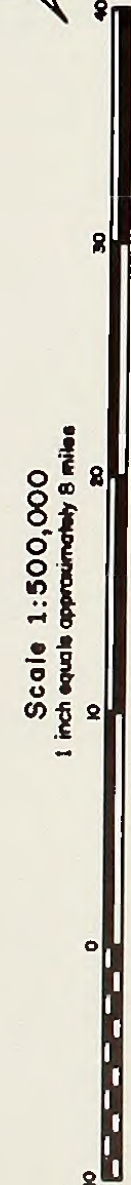
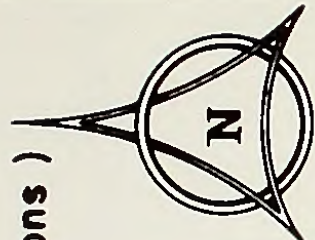
Key Range (yearlong or winter concentration areas)



Other Important Deer Range

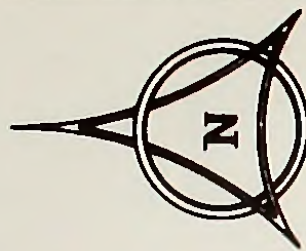


"Out" Areas (no deer or very low populations)

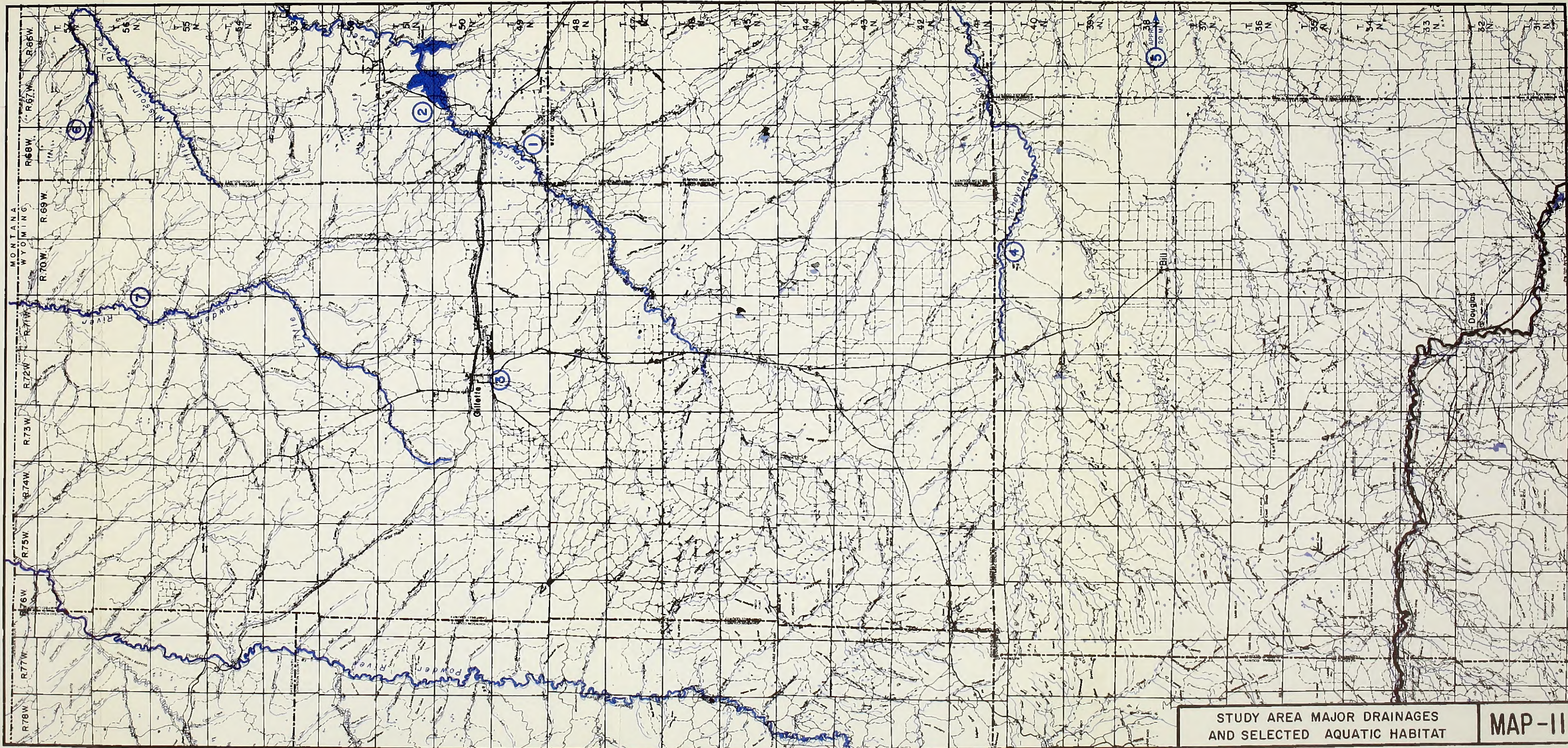


LEGEND

- ① Belle Fourche River
- ② Keyhole Reservoir
- ③ Gillette Fishing Lake
- ④ South Fork Cheyenne River
- ⑤ Old Woman Creek
- ⑥ North Fork Little Missouri River
- ⑦ Little Powder River



Scale 1:500,000
1 inch equals approximately 8 miles



STUDY AREA MAJOR DRAINAGES
AND SELECTED AQUATIC HABITAT

MAP-II

LEGEND

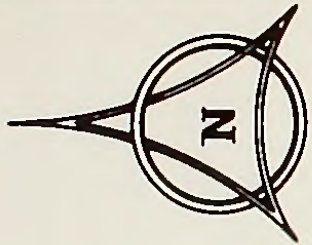
Existing Railroad Line

Proposed Railroad Location

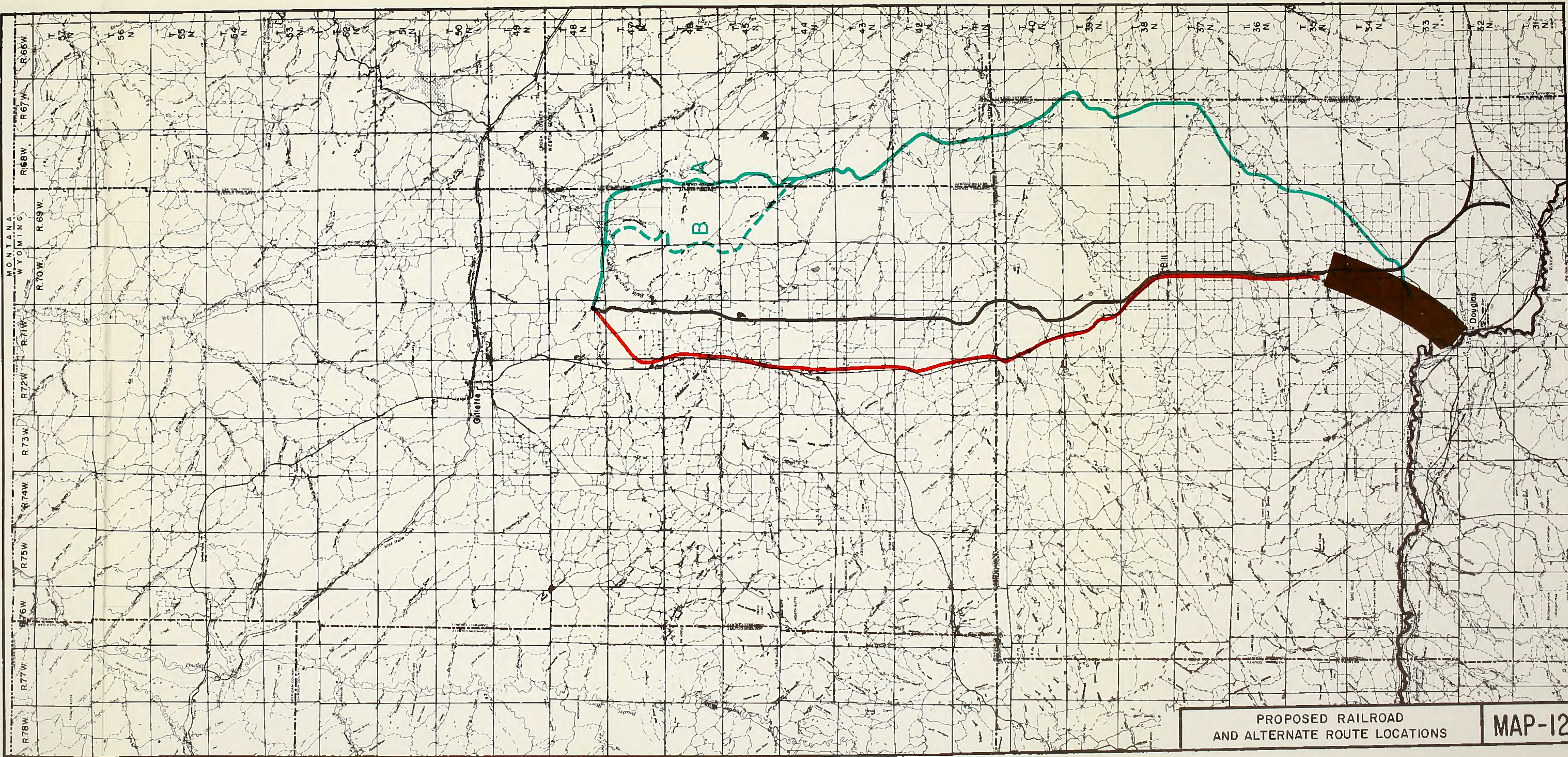
Eastern Alternate Route A&B

Western Alternate Route

Douglas Corridor



Scale 1:500,000
1 inch equals approximately 8 miles



PROPOSED RAILROAD
AND ALTERNATE ROUTE LOCATIONS

MAP-12

SELECTED BIBLIOGRAPHIES

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References - Parts II through VI	B-33
References - Additions During Preparation of FES . .	B-37

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for
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APPENDIX C

Supporting Data Related to Part I

Forest Service Objectives and Procedures
Relative to Federal Coal Leasing
on Thunder Basin National Grassland

Stipulations for lands under jurisdiction of Department of Agriculture, the supplemental stipulations to be attached thereto, and BLM lease terms provide the means by which the Forest Service objectives can be met:

1. Preplan the entire lease area, affected adjacent areas, and offsite supporting facilities based upon
 - a. Adequate resource and other pertinent data provided by the lessee to enable the mining plan (including reclamation) for the leased area to be prepared and approved prior to the time mining development actually commences; and
 - b. Selection of the most appropriate mining and reclamation system to
 - (1) Minimize environmental disturbance, and
 - (2) Provide for recovery of onsite minerals, including coal in a single or sequential preplanned operation.
2. In surface mining, the operation will seek to reclaim the surface to achieve beneficial future use of the land in a harmonious and judicious pattern by predetermining the post mining landform for
 - a. Urban development, including recreational, commercial, etc.;
 - b. Wildlife and recreation related, including water developments;
 - c. Agricultural cropland;

d. Uses similar to those made of the pre-mining land configuration; or the

3. Most desirable combination of above.

The mining plan (including reclamation) should be a flexible tool capable of periodic review to incorporate advances in technology. The Forest Service will determine whether or not it will concur in the mining plan to be approved by U.S. Geological Survey and will recommend modifications it considers necessary prior to plan acceptance.

The Forest Service will require a Lessee Surface Management Operation Plan which will more specifically indicate how Forest Service requirements will be met. When changes in operation are anticipated, such a plan will be modified and submitted to the Forest Supervisor for approval. The Forest Service will periodically review the mining operations, as they affect surface values, against the BLM general requirements, the Forest Service Lessee Surface Management Operation Plan, and the approved exploration or mining plan (including reclamation) prepared for that operation.

CLIMATE
Supporting Data

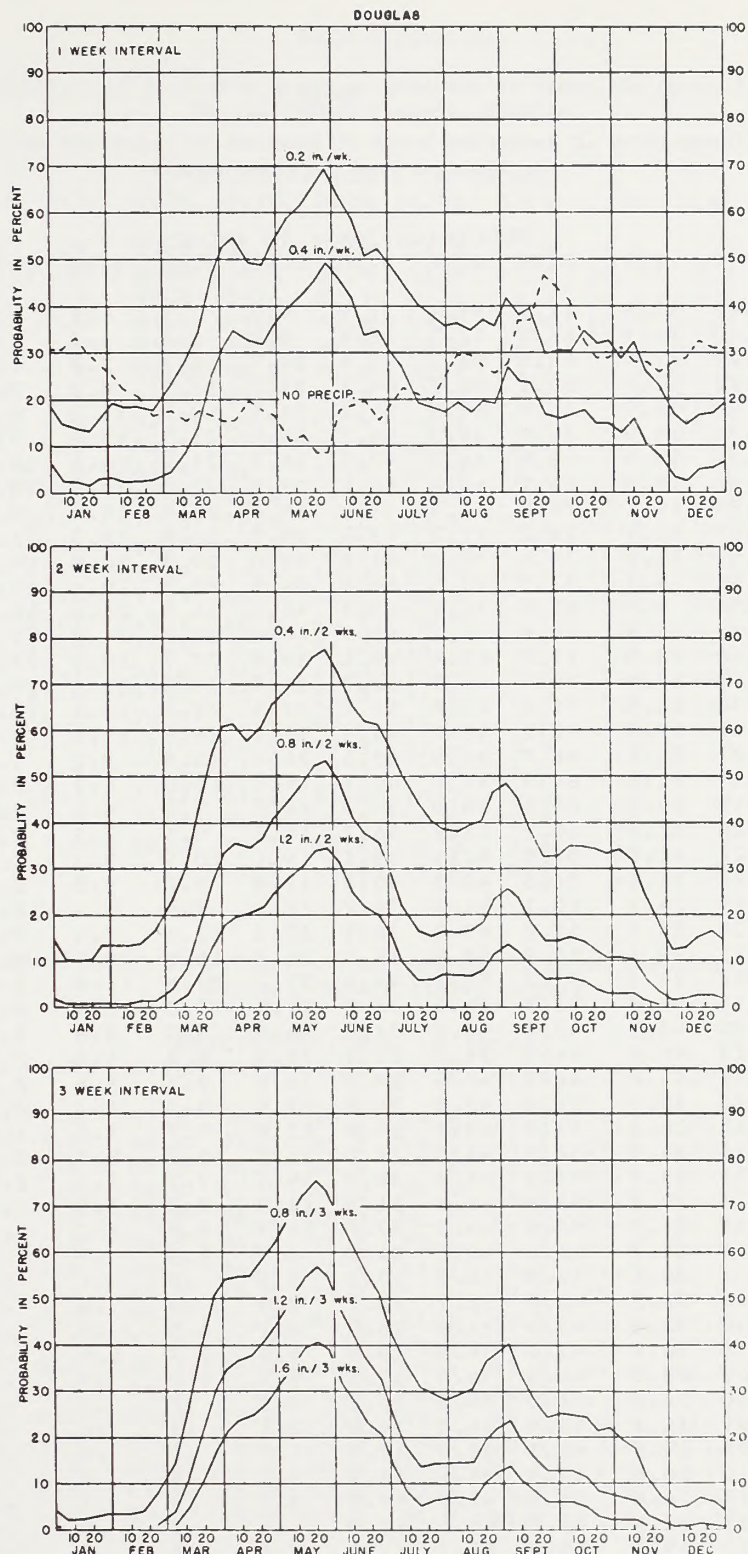


Figure 1

Probability, in percent, of Receiving Trace or Less and Exceeding Indicated Amounts
of Precipitation During One, Two, and Three Week Intervals, Douglas

Source: Clarence F. Becker and John D. Alyea, 1964a, PRECIPITATION PROBABILITIES IN WYOMING. Bulletin 416. Laramie, Wyoming: Agricultural Experiment Station, University of Wyoming.

Table 1

Percent Probability of Receiving Trace or Less and At Least the Amounts Indicated
During 1-Week Periods, Douglas

PERIOD BEGIN	PRECIPITATION - IN INCHES										
	AVE.	O.T.	0.06	0.10	0.20	0.40	0.60	0.80	1.00	1.40	2.00
MAR 1	.12	15.8	62.1	47.1	21.9	4.2	.7	.1	.0	.0	.0
MAR 8	.15	14.9	66.0	52.7	28.5	8.2	2.6	.8	.3	.0	.0
MAR 15	.21	17.4	65.4	55.2	35.4	14.7	6.3	2.8	1.2	.2	.0
MAR 22	.22	17.4	68.1	60.1	44.1	23.7	12.7	6.8	3.5	.9	.1
MAR 29	.41	14.9	75.7	69.5	55.2	33.5	19.7	11.4	6.5	2.0	.3
APR 5	.36	14.9	74.4	68.3	54.7	34.4	21.3	13.2	8.2	3.2	.8
APR 12	.36	19.9	65.8	59.7	47.9	31.7	21.4	14.6	10.2	5.0	1.7
APR 19	.42	19.9	66.7	60.6	48.6	32.3	22.0	15.1	10.5	5.2	1.8
APR 26	.35	14.1	74.0	67.5	53.8	34.6	22.5	14.8	9.7	4.3	1.2
MAY 3	.47	12.4	77.2	71.2	58.4	39.5	26.8	18.3	12.5	5.8	1.7
MAY 10	.53	11.6	79.4	73.9	61.8	43.0	29.9	20.8	14.4	6.9	2.1
MAY 17	.45	9.1	82.9	77.5	64.8	44.5	30.3	20.4	13.7	6.2	1.8
MAY 24	.54	8.3	85.6	80.9	69.3	49.2	34.3	23.6	16.1	7.4	2.2
MAY 31	.63	15.8	79.5	75.7	65.9	48.4	34.7	24.5	17.2	8.3	2.6
JUN 7	.36	23.3	69.7	65.4	55.4	39.4	27.7	19.3	13.4	6.4	2.0
JUN 14	.43	17.4	70.7	64.7	52.3	34.7	23.3	15.7	10.6	4.8	1.3
JUN 21	.36	14.9	71.4	64.8	51.7	33.9	22.6	15.1	10.2	4.6	1.3
JUN 28	.41	19.9	68.2	62.0	49.1	31.3	20.4	13.4	8.9	4.1	1.2
JUL 5	.27	21.6	66.7	59.9	45.6	26.4	15.4	9.2	5.5	2.1	.5
JUL 12	.24	21.6	64.9	56.8	40.1	19.9	10.0	5.2	2.6	.7	.0
JUL 19	.18	19.9	64.3	55.3	37.2	16.8	7.9	4.0	2.1	.6	.0
JUL 26	.25	22.4	60.2	51.9	36.2	18.2	9.5	5.2	2.9	.9	.1
AUG 2	.20	31.6	54.5	47.9	35.1	19.1	10.4	5.7	3.1	.8	.0
AUG 9	.22	31.6	56.5	49.5	35.3	17.8	9.0	4.5	2.2	.5	.0
AUG 16	.19	24.1	60.1	51.9	36.2	18.1	9.4	5.0	2.8	.9	.2
AUG 23	.29	25.7	57.0	49.7	36.1	20.3	12.0	7.4	4.6	1.9	.5
AUG 30	.21	29.1	56.9	50.9	39.5	24.7	15.8	10.2	6.6	2.7	.7
SEP 6	.42	33.3	57.2	52.2	41.9	27.2	17.8	11.6	7.7	3.2	.8
SEP 13	.17	40.8	51.3	46.4	36.0	21.5	13.0	7.9	4.9	1.8	.4
SEP 20	.20	43.3	48.1	42.8	31.5	16.8	9.0	4.8	2.6	.7	.0
SEP 27	.19	45.8	44.9	39.8	29.3	15.9	8.8	4.9	2.8	.9	.1
OCT 4	.16	41.6	46.8	40.9	29.5	15.6	8.3	4.5	2.4	.6	.0
OCT 11	.22	30.7	55.8	48.8	34.8	17.9	9.2	4.7	2.3	.5	.0
OCT 18	.22	28.2	57.6	49.4	33.6	15.9	7.7	3.8	1.8	.4	.0
OCT 25	.11	29.9	54.5	45.5	28.9	12.3	5.7	2.7	1.3	.3	.0
NOV 1	.23	29.9	54.2	45.9	30.7	14.5	7.2	3.6	1.8	.3	.0
NOV 8	.16	29.1	53.8	45.9	31.3	15.0	7.3	3.5	1.6	.2	.0
NOV 15	.18	26.6	52.8	43.3	27.1	11.3	4.9	2.2	.9	.0	.0
NOV 22	.11	25.7	51.2	40.0	21.8	6.9	2.4	.9	.3	.0	.0
NOV 29	.11	26.6	48.8	36.4	17.2	3.8	.8	.1	.0	.0	.0
DEC 6	.08	28.2	45.8	32.7	13.7	2.3	.3	.0	.0	.0	.0
DEC 13	.08	32.4	43.5	31.9	15.0	4.1	1.5	.7	.3	.0	.0
DEC 20	.15	32.4	45.0	34.6	18.8	6.8	2.9	1.4	.6	.1	.0
DEC 27	.09	29.1	46.3	34.9	17.5	5.1	1.8	.7	.3	.0	.0
JAN 3	.10	31.6	46.0	34.2	15.5	3.2	.7	.1	.0	.0	.0
JAN 10	.09	34.1	46.4	34.0	14.0	2.2	.3	.0	.0	.0	.0
JAN 17	.08	29.9	46.3	32.9	12.9	1.7	.1	.0	.0	.0	.0
JAN 24	.10	26.6	48.5	35.6	15.9	3.0	.5	.0	.0	.0	.0
JAN 31	.12	26.6	55.4	42.7	19.7	3.7	.6	.1	.0	.0	.0
FEB 7	.12	22.4	60.0	45.6	18.9	2.4	.3	.0	.0	.0	.0
FEB 14	.10	19.1	56.9	41.7	17.1	2.4	.3	.0	.0	.0	.0
FEB 21	.12	19.1	56.3	41.7	18.8	3.6	.6	.1	.0	.0	.0

Source: Clarence F. Becker and John D. Alyea, 1964a, PRECIPITATION PROBABILITIES IN WYOMING. Bulletin 416. Laramie, Wyoming: Agricultural Experiment Station, University of Wyoming.

Table 1 (Cont'd)

Percent Probability of Receiving Trace or Less and At Least the Amounts Indicated
During 2-Week Periods, Douglas

PERIOD			PRECIPITATION - IN INCHES									
BEGIN		AVE.	O.T.	0.06	0.10	0.20	0.40	0.60	1.00	1.40	2.00	4.00
MAR 1		.27	2.4	89.8	81.4	56.9	21.6	7.9	1.4	.3	.0	.0
MAR 15		.43	5.7	86.0	79.9	65.4	42.6	27.5	11.3	4.7	1.2	.2
MAR 29		.77	3.3	92.8	89.6	80.7	62.8	47.2	25.1	12.8	4.4	.0
APR 12		.78	2.4	89.6	85.0	74.6	57.5	44.5	26.7	16.0	7.3	.2
APR 26		.82	1.6	93.9	90.6	82.0	65.8	52.0	31.6	18.8	8.4	.4
MAY 10		.98	4.9	92.4	90.2	84.0	70.7	58.3	38.2	24.4	12.1	1.0
MAY 24	1	1.18	4.1	94.8	93.7	89.8	79.0	66.9	44.8	28.2	13.1	.7
JUN 7		.79	2.4	92.7	89.2	80.4	64.3	50.8	31.1	18.7	8.6	.5
JUN 21		.77	4.9	90.5	87.0	77.9	60.8	46.8	27.0	15.3	6.4	.2
JUL 5		.52	6.6	88.9	84.7	72.6	50.0	33.2	14.3	6.1	1.7	.0
JUL 19		.43	1.6	86.7	79.8	64.1	40.3	24.9	9.5	3.7	.9	.0
AUG 2		.42	10.7	77.1	70.7	57.0	37.4	24.6	10.8	4.7	1.2	.2
AUG 16		.47	6.6	82.7	76.2	62.1	41.2	27.4	12.2	5.5	1.6	.0
AUG 30		.63	11.6	81.8	77.5	67.3	49.9	36.6	19.3	10.0	3.6	.0
SEP 13		.37	16.6	71.9	66.1	54.0	36.7	25.3	12.2	5.9	1.9	.0
SEP 27		.35	19.9	68.1	62.0	49.5	32.2	21.1	9.1	3.9	1.0	.0
OCT 11		.45	12.4	76.5	70.1	56.2	36.2	23.4	9.8	4.0	1.0	.0
OCT 25		.34	9.1	81.6	74.5	57.9	33.0	18.3	5.4	1.5	.2	.0
NOV 8		.34	11.6	77.5	70.4	54.5	31.8	18.2	5.8	1.7	.2	.0
NOV 22		.22	6.6	73.0	61.8	40.6	17.7	7.8	1.6	.2	.0	.0
DEC 6		.16	11.6	71.0	58.8	34.8	11.6	3.9	.5	.0	.0	.0
DEC 20		.24	7.4	73.0	61.8	40.3	17.0	7.3	1.3	.1	.0	.0
JAN 3		.19	12.4	73.3	61.2	36.0	10.7	2.9	.1	.0	.0	.0
JAN 17		.18	7.4	74.3	61.2	35.3	10.4	2.8	.1	.0	.0	.0
JAN 31		.24	7.4	85.3	75.7	48.6	14.3	3.3	.0	.0	.0	.0
FEB 14		.22	1.6	84.3	71.7	43.6	13.6	4.0	.3	.0	.0	.0

Percent Probability of Receiving Trace or Less and At Least the Amounts Indicated
During 3-Week Periods, Douglas

PERIOD			PRECIPITATION - IN INCHES									
BEGIN		AVE.	O.T.	0.06	0.10	0.20	0.40	0.60	1.00	1.40	2.00	4.00
MAR 1		.48	.0	97.6	94.1	80.7	49.8	27.4	7.7	2.3	.4	.0
MAR 22		.99	1.6	97.4	96.2	91.5	78.6	64.4	39.8	23.0	9.4	.3
APR 12	1	1.13	1.6	96.5	94.8	89.4	77.5	65.7	45.5	30.6	16.4	1.7
MAY 3	1	1.45	.8	98.3	97.3	94.2	85.9	76.3	57.4	41.3	24.1	3.2
MAY 24	1	1.54	.8	98.8	98.3	96.5	90.5	82.5	63.9	46.4	26.5	2.8
JUN 14	1	1.20	.0	98.3	96.7	91.6	79.6	67.3	45.8	30.0	15.3	1.4
JUL 5		.70	1.6	96.5	94.3	86.6	67.7	50.0	25.0	11.8	3.7	.1
JUL 26		.67	1.6	90.8	85.8	74.1	54.4	39.5	20.7	10.8	4.0	.0
AUG 16		.69	3.3	93.0	89.7	80.6	62.6	47.3	26.0	14.0	5.5	.2
SEP 6		.79	6.6	87.6	83.8	74.7	58.5	45.2	26.4	15.2	6.5	.2
SEP 27		.57	5.8	86.1	80.9	68.8	49.4	35.2	17.8	8.9	3.1	.0
OCT 18		.56	4.1	91.4	87.6	76.2	53.1	34.9	13.8	5.1	1.0	.0
NOV 8		.45	4.1	89.4	83.8	69.4	45.1	28.2	10.4	3.7	.7	.0
NOV 29		.27	4.9	85.0	76.1	54.4	24.9	10.7	1.8	.2	.0	.0
DEC 20		.34	.8	88.9	80.0	58.4	28.3	13.1	2.7	.5	.0	.0
JAN 10		.26	2.4	87.8	78.0	53.9	22.0	8.1	.8	.0	.0	.0
JAN 31		.33	.8	95.6	89.7	69.0	30.9	11.5	1.2	.0	.0	.0

Source: Clarence F. Becker and John D. Alyea, 1964a, PRECIPITATION PROBABILITIES IN WYOMING. Bulletin 416. Laramie, Wyoming: Agricultural Experiment Station, University of Wyoming.

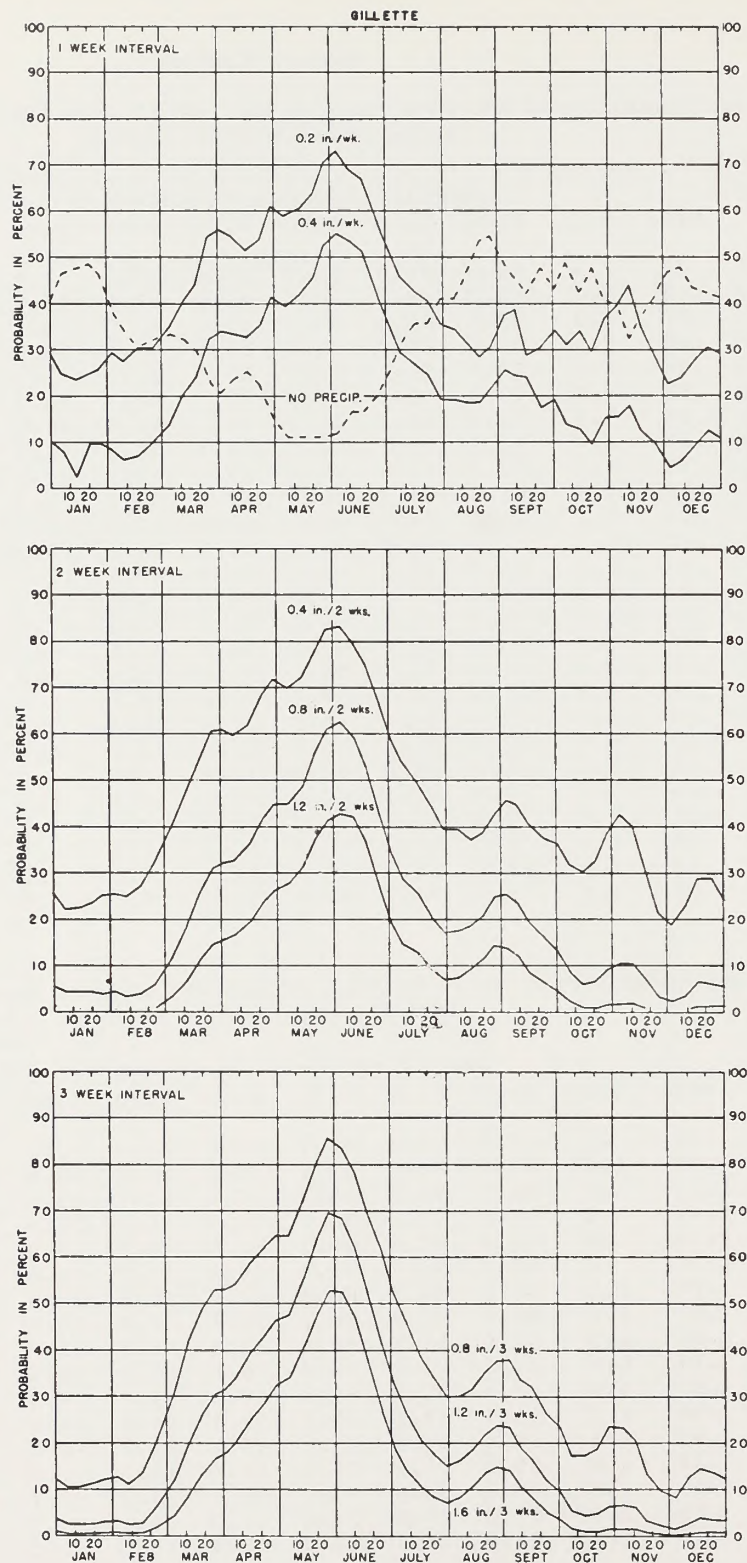


Figure 2

Probability, in percent, of Receiving Trace or Less and Exceeding Indicated Amounts of Precipitation During One, Two, and Three Week Intervals, Gillette

Source: Clarence F. Becker and John D. Alyea, 1964a, PRECIPITATION PROBABILITIES IN WYOMING. Bulletin 416. Laramie, Wyoming: Agricultural Experiment Station, University of Wyoming.

Table 2

Percent Probability of Receiving Trace or Less and At Least the Amounts Indicated
During 1-Week Periods, Gillette

PERIOD BEGIN	PRECIPITATION - IN INCHES										
	Ave.	0.1	0.06	0.10	0.20	0.40	0.60	0.80	1.00	1.40	2.00
MAR 1	.19	32.4	59.9	52.8	35.9	14.7	5.7	2.2	.8	.0	.0
MAR 8	.21	33.3	60.4	54.7	40.6	20.2	9.4	4.3	1.9	.3	.0
MAR 15	.28	29.9	63.8	58.4	45.1	24.8	13.0	6.7	3.3	.8	.0
MAR 22	.28	23.3	70.6	65.5	52.5	30.8	16.8	8.7	4.4	1.0	.0
MAR 29	.40	19.9	75.5	71.4	59.4	36.3	20.1	10.5	5.4	1.3	.1
APR 5	.33	23.3	71.1	66.4	54.2	33.0	18.8	10.3	5.6	1.5	.1
APR 12	.27	26.6	66.8	61.7	49.7	30.8	18.7	11.2	6.7	2.3	.4
APR 19	.44	22.4	71.3	66.6	55.3	36.9	24.1	15.5	9.9	4.0	1.0
APR 26	.43	14.9	77.6	72.5	60.4	40.8	27.2	17.9	11.7	4.9	1.3
MAY 3	.47	10.8	79.5	73.6	60.5	40.3	26.7	17.6	11.6	4.9	1.3
MAY 10	.41	10.8	77.7	71.7	59.0	40.4	27.9	19.3	13.4	6.5	2.2
MAY 17	.60	11.6	79.7	74.8	63.8	45.8	32.7	23.2	16.5	8.3	3.0
MAY 24	.54	10.8	84.9	81.3	71.5	52.7	37.4	26.1	18.1	8.5	2.7
MAY 31	.66	11.6	85.2	82.2	73.4	55.6	40.7	29.2	20.7	10.2	3.4
JUN 7	.65	16.6	80.0	77.2	69.3	54.0	41.0	30.6	22.6	12.2	4.6
JUN 14	.61	18.3	77.2	74.0	65.7	50.8	38.7	29.2	21.9	12.2	5.0
JUN 21	.62	17.4	75.8	71.4	61.0	44.4	32.3	23.5	17.2	9.2	3.6
JUN 28	.29	24.9	67.2	62.1	50.5	33.2	21.8	14.4	9.5	4.3	1.3
JUL 5	.30	32.4	60.7	56.1	45.5	29.3	18.6	11.8	7.4	2.9	.7
JUL 12	.38	34.1	59.4	54.9	44.4	28.4	18.2	11.7	7.5	3.2	.8
JUL 19	.20	37.5	55.7	50.8	39.4	22.9	13.3	7.8	4.6	1.7	.4
JUL 26	.24	40.8	52.3	47.4	36.1	20.2	11.0	6.0	3.2	.9	.1
AUG 2	.20	41.6	50.4	45.2	34.1	19.0	10.4	5.6	3.0	.8	.0
AUG 9	.19	44.9	46.5	41.7	31.6	18.3	10.7	6.3	3.8	1.3	.3
AUG 16	.25	54.1	39.3	35.9	28.8	19.1	12.9	8.8	6.2	3.0	1.0
AUG 23	.23	56.6	38.1	35.3	29.4	20.7	14.7	10.4	7.5	3.8	1.4
AUG 30	.29	47.4	47.8	44.8	37.6	26.0	17.6	11.9	8.0	3.6	1.1
SEP 6	.34	44.1	52.1	49.0	40.7	26.7	17.0	10.7	6.7	2.6	.6
SEP 13	.16	44.9	49.8	45.9	36.2	21.5	12.5	7.2	4.1	1.4	.2
SEP 20	.27	44.1	48.2	43.5	33.3	19.2	11.0	6.3	3.6	1.1	.1
SEP 27	.15	46.6	46.0	41.5	31.6	18.0	10.1	5.6	3.1	.9	.0
OCT 4	.21	46.6	48.5	44.3	32.7	15.3	7.2	3.5	1.7	.3	.0
OCT 11	.13	44.1	52.6	48.1	33.3	11.6	3.8	1.3	.5	.1	.0
OCT 18	.16	44.9	50.8	45.6	30.5	10.1	2.9	.7	.1	.0	.0
OCT 25	.13	44.9	50.8	46.1	33.2	14.0	5.1	1.7	.5	.0	.0
NOV 1	.24	37.4	60.0	56.3	42.2	17.3	5.8	1.8	.4	.0	.0
NOV 8	.18	32.4	64.3	59.8	43.3	16.1	5.2	1.7	.5	.0	.0
NOV 15	.21	35.8	57.7	51.6	35.5	13.8	5.2	2.0	.8	.1	.0
NOV 22	.12	41.6	51.2	44.1	27.3	9.2	3.2	1.1	.4	.0	.0
NOV 29	.11	46.6	48.1	41.0	22.4	4.5	.7	.1	.0	.0	.0
DEC 6	.10	48.3	47.0	40.5	23.0	5.6	1.4	.4	.1	.0	.0
DEC 13	.15	44.1	49.1	42.8	27.6	10.3	3.8	1.4	.5	.0	.0
DEC 20	.17	39.9	52.2	45.7	30.9	12.5	4.7	1.7	.6	.0	.0
DEC 27	.14	42.4	50.8	44.4	29.3	10.7	3.6	1.1	.3	.0	.0
JAN 3	.13	45.8	46.3	39.7	25.2	8.7	2.7	.7	.2	.0	.0
JAN 10	.11	48.3	42.6	36.1	22.9	8.5	3.0	.9	.3	.0	.0
JAN 17	.13	49.1	43.6	37.9	25.3	10.2	3.8	1.3	.4	.0	.0
JAN 24	.15	46.6	46.5	40.5	26.9	10.5	3.8	1.3	.3	.0	.0
JAN 31	.12	39.9	52.6	45.4	28.0	8.5	2.4	.6	.1	.0	.0
FEB 7	.17	32.4	60.0	51.6	30.1	6.9	1.2	.1	.0	.0	.0
FEB 14	.13	31.6	59.6	50.6	29.1	7.0	1.3	.2	.0	.0	.0
FEB 21	.15	32.4	58.8	50.4	30.9	9.7	2.8	.8	.2	.0	.0

Source: Clarence F. Becker and John D. Alyea, 1964a, PRECIPITATION PROBABILITIES IN WYOMING. Bulletin 416. Laramie, Wyoming: Agricultural Experiment Station, University of Wyoming.

Table 2 (Cont'd)

Percent Probability of Receiving Trace or Less and At Least the Amounts Indicated
During 2-Week Periods, Gillette

PERIOD BEGIN	PRECIPITATION - IN INCHES										
	AVE.	O.T.	0.06	0.10	0.20	0.40	0.60	1.00	1.40	2.00	4.00
MAR 1	.40	10.8	86.3	82.4	68.9	41.2	22.3	5.9	1.5	.2	.0
MAR 15	.56	7.4	88.7	85.0	74.5	53.9	37.4	16.8	7.2	1.8	.0
MAR 29	.73	5.8	91.5	88.8	80.4	62.1	45.8	23.2	11.1	3.3	.0
APR 12	.71	10.0	87.4	84.8	77.4	61.6	47.2	26.2	13.8	5.0	.0
APR 26	.90	4.9	93.4	91.6	85.7	71.5	57.3	34.4	19.6	7.9	.2
MAY 10	1.01	4.9	92.5	90.3	84.0	70.8	58.5	38.8	25.1	12.8	1.2
MAY 24	1.20	3.3	96.0	95.2	92.5	84.1	73.4	51.2	33.1	15.9	1.0
JUN 7	1.26	4.9	93.9	92.7	88.9	79.3	69.0	50.1	35.0	19.7	2.3
JUN 21	.90	5.8	91.3	88.6	81.4	66.6	53.6	33.8	21.0	10.3	.9
JUL 5	.68	11.6	84.3	80.9	71.7	54.3	40.2	21.2	10.9	3.9	.1
JUL 19	.43	17.4	77.3	73.1	62.4	43.6	29.7	13.2	5.7	1.5	.0
AUG 2	.39	19.9	72.9	68.1	56.6	38.3	25.4	11.0	4.6	1.2	.0
AUG 16	.47	29.9	63.3	59.5	50.9	37.7	28.0	15.7	8.9	3.8	.1
AUG 30	.63	21.6	73.5	70.1	61.7	47.0	35.3	19.6	10.7	4.2	.1
SEP 13	.43	21.6	72.4	68.2	57.6	40.2	27.6	12.6	5.6	1.7	.0
SEP 27	.37	19.9	74.2	69.4	56.8	35.5	21.5	7.9	3.0	.7	.0
OCT 11	.29	17.4	77.8	72.3	56.5	29.5	13.9	2.5	.3	.0	.0
OCT 25	.37	18.2	79.9	77.1	65.6	38.9	19.8	3.9	.5	.0	.0
NOV 8	.39	14.1	83.6	80.3	67.9	40.4	20.9	4.5	.7	.0	.0
NOV 22	.23	22.4	73.1	67.2	49.1	21.3	8.7	1.3	.1	.0	.0
DEC 6	.25	25.0	71.5	66.5	50.0	23.1	9.8	1.6	.1	.0	.0
DEC 20	.31	15.8	77.6	71.5	55.3	29.0	14.1	3.1	.6	.0	.0
JAN 3	.24	19.9	69.7	62.3	45.3	21.8	10.0	2.0	.3	.0	.0
JAN 17	.28	14.9	77.9	70.7	51.8	23.8	9.9	1.4	.1	.0	.0
JAN 31	.28	14.1	79.6	72.8	54.2	25.7	11.0	1.6	.0	.0	.0
FEB 14	.28	9.9	85.8	79.7	59.8	26.1	9.7	1.1	.0	.0	.0

Percent Probability of Receiving Trace or Less and At Least the Amounts Indicated
During 3-Week Periods, Gillette

PERIOD BEGIN	PRECIPITATION - IN INCHES										
	AVE.	O.T.	0.06	0.10	0.20	0.40	0.60	1.00	1.40	2.00	4.00
MAR 1	.68	4.1	95.1	93.8	87.6	68.1	47.8	19.8	7.2	1.3	.0
MAR 22	1.02	.8	98.5	97.6	93.6	81.2	66.7	40.6	22.7	8.6	.0
APR 12	1.14	4.9	94.3	93.4	90.1	80.4	69.2	48.0	31.5	15.7	1.0
MAY 3	1.47	.0	98.6	97.3	93.2	83.6	73.6	55.2	40.3	24.5	4.2
MAY 24	1.85	2.4	97.4	97.4	97.1	95.5	91.7	78.7	61.8	37.8	3.9
JUN 14	1.51	.8	98.7	98.1	95.7	88.4	79.4	60.7	44.4	26.3	3.6
JUL 5	.88	5.8	92.7	91.1	85.7	72.2	58.1	34.7	19.3	7.4	.1
JUL 26	.63	11.6	85.0	81.9	73.3	56.0	41.3	21.3	10.5	3.5	.0
AUG 16	.77	13.3	81.4	77.9	69.7	55.5	44.2	27.8	17.5	8.7	.8
SEP 6	.77	9.9	86.5	83.6	75.3	59.2	45.4	25.9	14.5	6.0	.2
SEP 27	.50	6.6	89.3	85.3	73.7	51.3	34.1	14.1	5.6	1.2	.0
OCT 18	.53	9.1	89.7	87.8	79.5	55.7	34.0	10.0	2.3	.0	.0
NOV 8	.51	5.8	92.2	89.4	79.3	55.0	34.4	11.2	3.1	.3	.0
NOV 29	.35	12.4	84.8	80.7	66.5	37.5	18.5	3.7	.4	.0	.0
DEC 20	.44	4.1	90.2	84.6	69.3	42.7	24.8	7.7	2.2	.3	.0
JAN 10	.39	5.8	89.3	83.9	67.9	39.0	20.4	4.9	1.0	.0	.0
JAN 31	.41	2.5	91.9	86.4	71.0	42.7	23.7	6.5	1.6	.1	.0

Source: Clarence F. Becker and John D. Alyea, 1964a, PRECIPITATION PROBABILITIES IN WYOMING. Bulletin 416. Laramie, Wyoming: Agricultural Experiment Station, University of Wyoming.

Table 3

Probability That a Given Day Will Be Wet or Dry, Douglas

 $P(WET)=1 - P(DRY)$ $P(WET/DRY)=1 - P(DRY/DRY)$ $P(WET/WET)=1 - P(DRY/WET)$

PERIOD	WET \geq 0.01 INCHES			WET \geq 0.05 INCHES			WET \geq 0.10 INCHES		
BEGINS	DRY	DRY/DRY	DRY/WET	DRY	DRY/DRY	DRY/WET	DRY	DRY/DRY	DRY/WET
MAR 01	76	78	70	89	89	87	95	95	89+
MAR 08	77	80	68	88	90	75	94	94	78
MAR 15	80	81	78	88	88	86	91	92	85
MAR 22	74	79	61	86	89	74	92	93	86
MAR 29	71	76	65	79	81	75	83	85	78
APR 05	70	76	56	80	83	70	87	90	73
APR 12	78	82	64	87	90	64	90	92	73
APR 19	75	82	51	82	85	66	88	90	69
APR 26	68	76	51	78	82	66	86	87	74
MAY 03	69	79	48	78	85	51	83	89	54
MAY 10	66	76	46	75	81	58	80	84	67
MAY 17	65	75	46	75	82	54	83	85	76
MAY 24	61	68	50	71	76	61	78	81	67
MAY 31	62	73	46	72	76	61	78	79	76
JUN 07	70	77	55	76	82	57	83	86	69
JUN 14	64	70	55	75	77	66	81	82	73
JUN 21	71	78	57	80	85	65	90	92	69
JUN 28	77	83	58	85	88	70	89	93	60
JUL 05	76	80	63	82	83	76	90	91	86
JUL 12	78	80	72	87	88	88	92	93	90
JUL 19	80	82	74	88	88	94	92	92	92
JUL 26	77	80	65	88	90	75	93	94	71
AUG 02	83	85	73	90	92	71	93	95	87
AUG 09	83	87	71	88	90	78	94	94	92
AUG 16	83	84	67	90	91	73	92	91	83
AUG 23	81	86	59	88	90	78	92	94	79
AUG 30	84	87	71	89	92	73	91	92	80
SEP 06	76	82	53	83	85	76	89	90	80
SEP 13	84	90	52	89	93	56	93	94	73
SEP 20	80	86	56	85	89	64	90	91	83
SEP 27	86	91	56	91	94	55	93	95	81
OCT 04	85	87	71	90	91	77	92	93	79
OCT 11	84	87	71	88	90	73	92	93	90
OCT 18	83	88	50	89	90	73	91	91	85
OCT 25	83	86	62	90	91	77	93	94	83
NOV 01	77	82	59	85	88	65	91	91	85
NOV 08	85	88	70	91	92	75	93	95	76
NOV 15	80	84	58	86	89	63	93	94	85
NOV 22	84	85	76	90	92	78	95	95	96
NOV 29	83	85	68	92	93	85	96	96	89+
DEC 06	80	81	76	90	90	88	95	96	86
DEC 13	86	87	80	92	94	76	97	98	87
DEC 20	83	85	71	90	90	90	95	96	78
DEC 27	84	84	82	93	94	82	98	98	92
JAN 03	80	82	76	91	92	83	96	96	75
JAN 10	81	84	67	92	92	88	96	96	89+
JAN 17	81	84	67	92	93	75	96	96	88
JAN 24	79	83	66	89	91	78	97	97	92
JAN 31	82	83	78	89	90	88	95	95	86
FEB 07	80	82	75	88	89	86	94	95	83
FEB 14	78	81	68	90	91	79	95	95	71
FEB 21	80	83	71	88	88	93	94	94	97

Source: Colorado State University Experiment Station. Probability of Sequence of Wet or Dry Days for 11 Western States and Texas. Technical Bulletin 117.

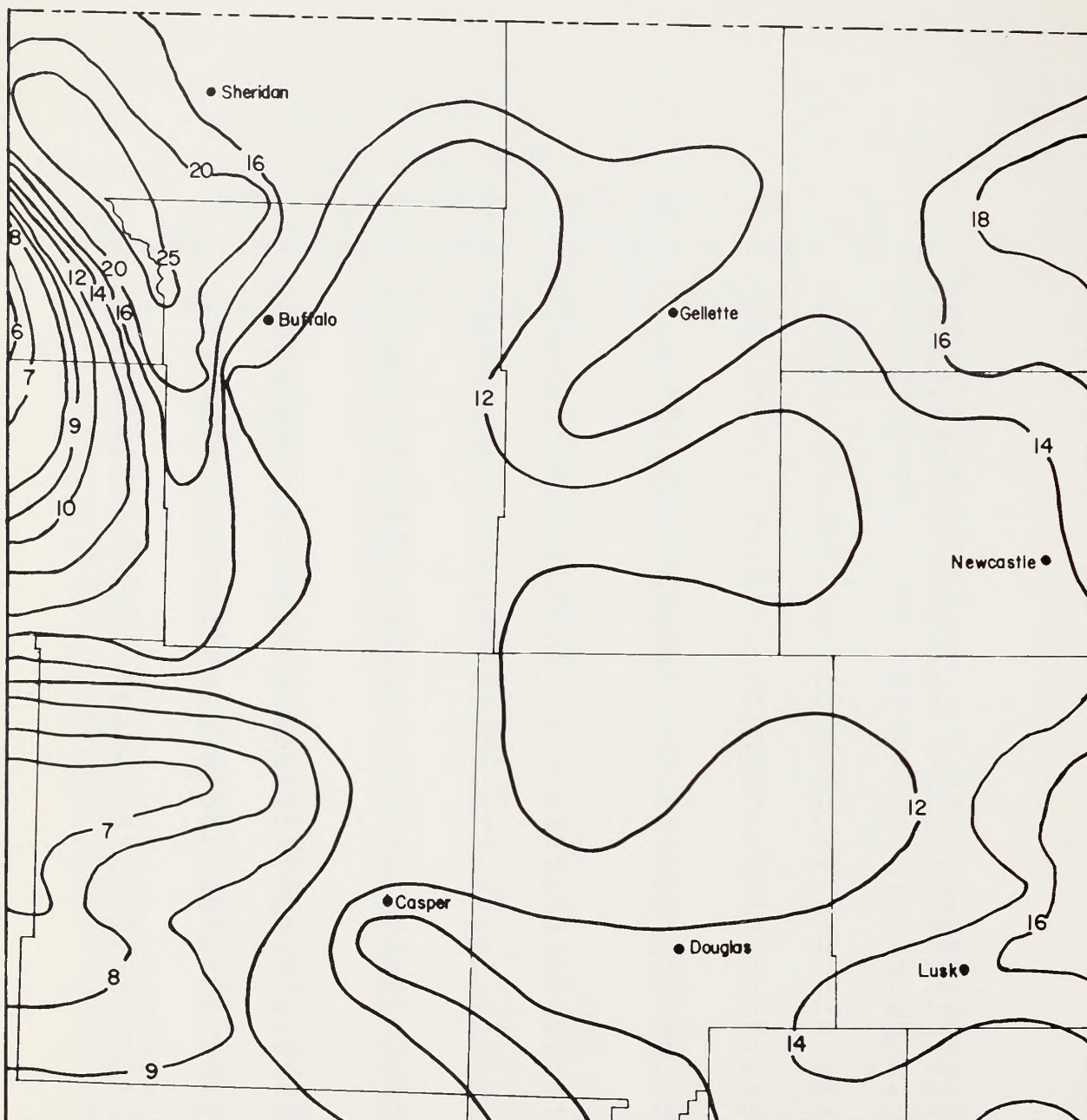
Table 4

Probability That a Given Day Will Be Wet or Dry, Gillette

 $P(WET)=1 - P(DRY)$ $P(WET/DRY)=1 - P(DRY/DRY)$ $P(WET/WET)=1 - P(DRY/WET)$

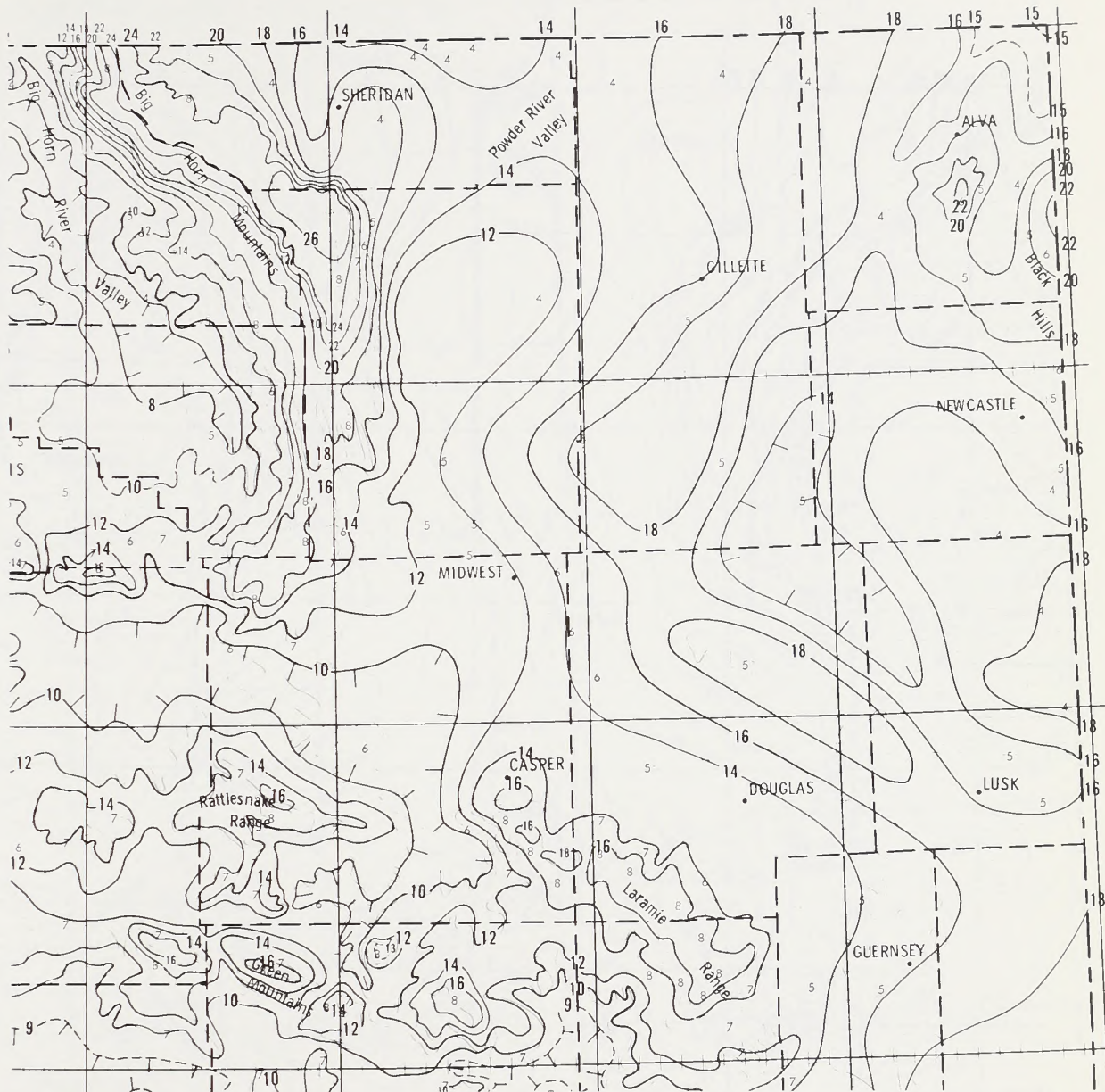
PERIOD	WET \geq 0.01 INCHES			WET \geq 0.05 INCHES			WET \geq 0.10 INCHES		
BEGINS	DRY	DRY/DRY	DRY/WET	DRY	DRY/DRY	DRY/WET	DRY	DRY/DRY	DRY/WET
MAR 01	82	82	73	86	85	82	92	92	88
MAR 08	81	85	59	86	90	58	92	93	68
MAR 15	83	83	79	85	86	83	91	91	97
MAR 22	81	80	83	84	84	81	90	91	81
MAR 29	75	78	71	78	80	70	83	85	81
APR 05	75	81	58	80	81	71	86	87	78
APR 12	83	84	74	87	87	84	89	89	89
APR 19	74	80	54	78	83	60	82	87	69
APR 26	70	74	60	76	80	64	83	87	70
MAY 03	68	72	61	75	77	68	84	87	70
MAY 10	71	76	57	78	81	61	82	83	67
MAY 17	73	81	56	78	82	65	83	86	69
MAY 24	68	74	53	73	77	56	80	81	70
MAY 31	64	69	56	69	72	63	77	79	70
JUN 07	65	71	53	71	75	61	78	84	57
JUN 14	72	76	62	77	80	68	82	85	67
JUN 21	67	73	58	75	77	71	81	83	76
JUN 28	83	86	71	87	89	74	90	93	88
JUL 05	83	87	57	86	89	60	91	92	79
JUL 12	82	82	87	85	85	93	88	89	92
JUL 19	86	88	74	88	89	79	92	93	91
JUL 26	81	85	65	85	85	82	89	89	82
AUG 02	88	90	76	91	92	85	94	95	79
AUG 09	86	87	85	89	90	81	92	93	90
AUG 16	88	89	85	91	91	92	93	94	90
AUG 23	88	90	78	92	92	88	94	95	93
AUG 30	84	88	62	86	89	71	90	91	87
SEP 06	85	87	78	87	88	79	89	90	82
SEP 13	83	90	49	85	90	53	89	93	54
SEP 20	81	85	64	85	88	69	90	91	82
SEP 27	88	91	62	92	94	60	94	95	76
OCT 04	87	89	72	88	90	72	92	93	80
OCT 11	90	92	80	92	92	88	92	93	86
OCT 18	87	90	67	90	92	77	93	94	89
OCT 25	90	91	88	91	92	91	93	94	93
NOV 01	83	84	71	84	85	72	88	89	81
NOV 08	84	86	69	87	88	72	91	93	70
NOV 15	84	87	70	86	88	72	91	92	87
NOV 22	88	89	77	90	91	82	94	95	83
NOV 29	87	90	65	89	90	88	94	95	92
DEC 06	88	90	67	90	91	69	94	94	92
DEC 13	88	87	91	90	91	93	96	97	91
DEC 20	81	81	78	86	86	83	92	92	92
DEC 27	84	87	67	88	89	74	94	95	80
JAN 03	83	85	75	88	90	72	94	95	93
JAN 10	84	88	62	91	92	79	95	96	80
JAN 17	81	88	52	87	90	64	95	95	94
JAN 24	83	88	56	89	90	85	94	94	94
JAN 31	85	86	80	89	89	91	96	96	93
FEB 07	80	81	77	83	83	85	91	91	97
FEB 14	81	82	76	87	86	86	93	93	95
FEB 21	82	85	67	86	88	80	94	94	99+

Source: Colorado State University Experiment Station. Probability of Sequence of Wet or Dry Days for 11 Western States and Texas. Technical Bulletin 117.

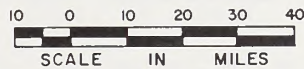


Source: By the Wyoming Water Planning Program In Cooperation with
E.S.S.A. Weather Bureau State Climatologist, Wyoming.

Figure 3
Mean Annual Precipitation as of 1965
(in Inches)



Prepared by :
 U.S. Department of Commerce
 For :
 U.S. Department of Agriculture
 August 1968

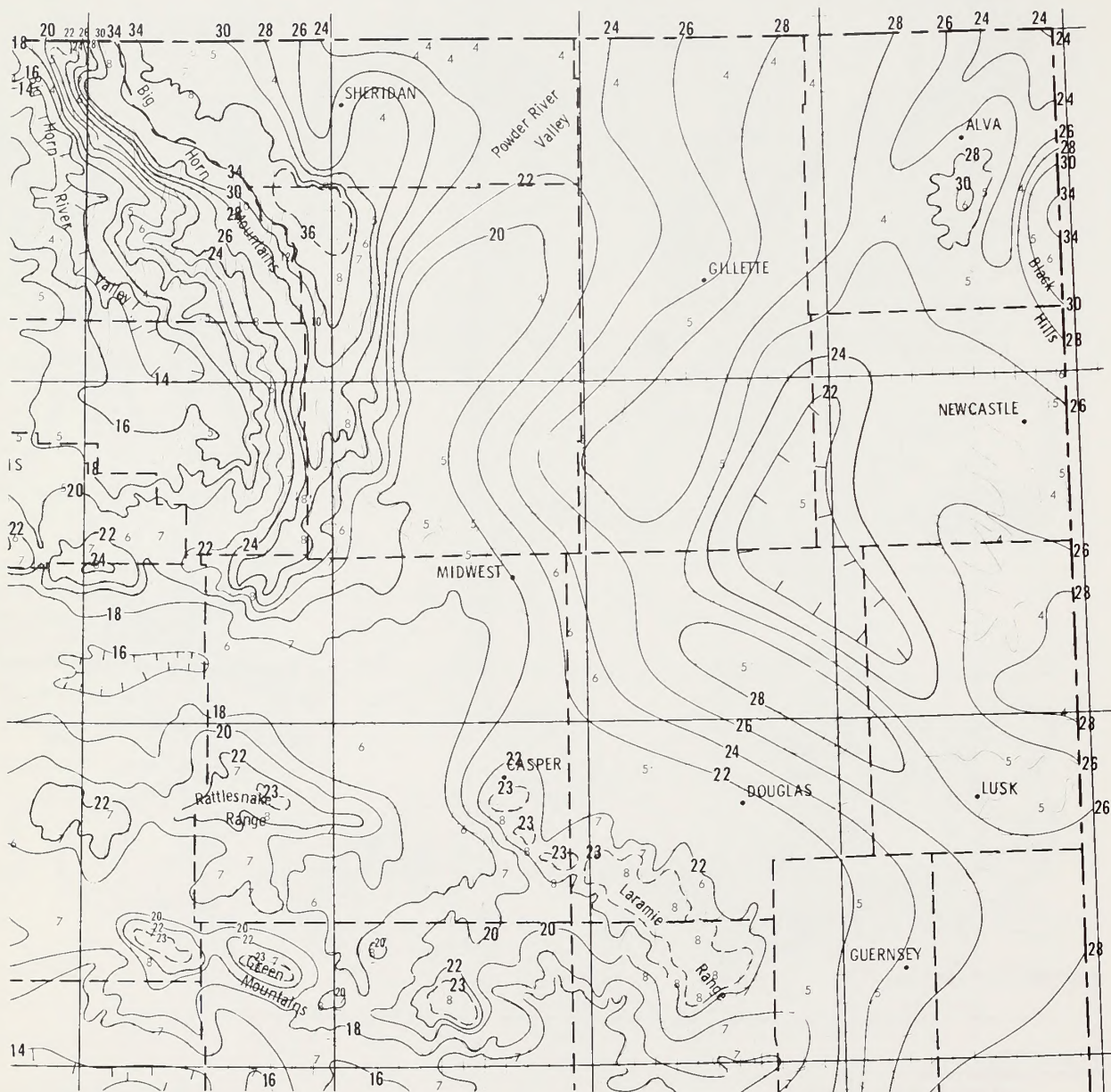


LEGEND

— 26 — Isopluviols of Precipitation
 in Tenths of an Inch Annual.

Figure 4

2 - Year 24-Hour Precipitation



Prepared by :
 U.S. Department of Commerce
 For :
 U.S. Department of Agriculture
 August 1968

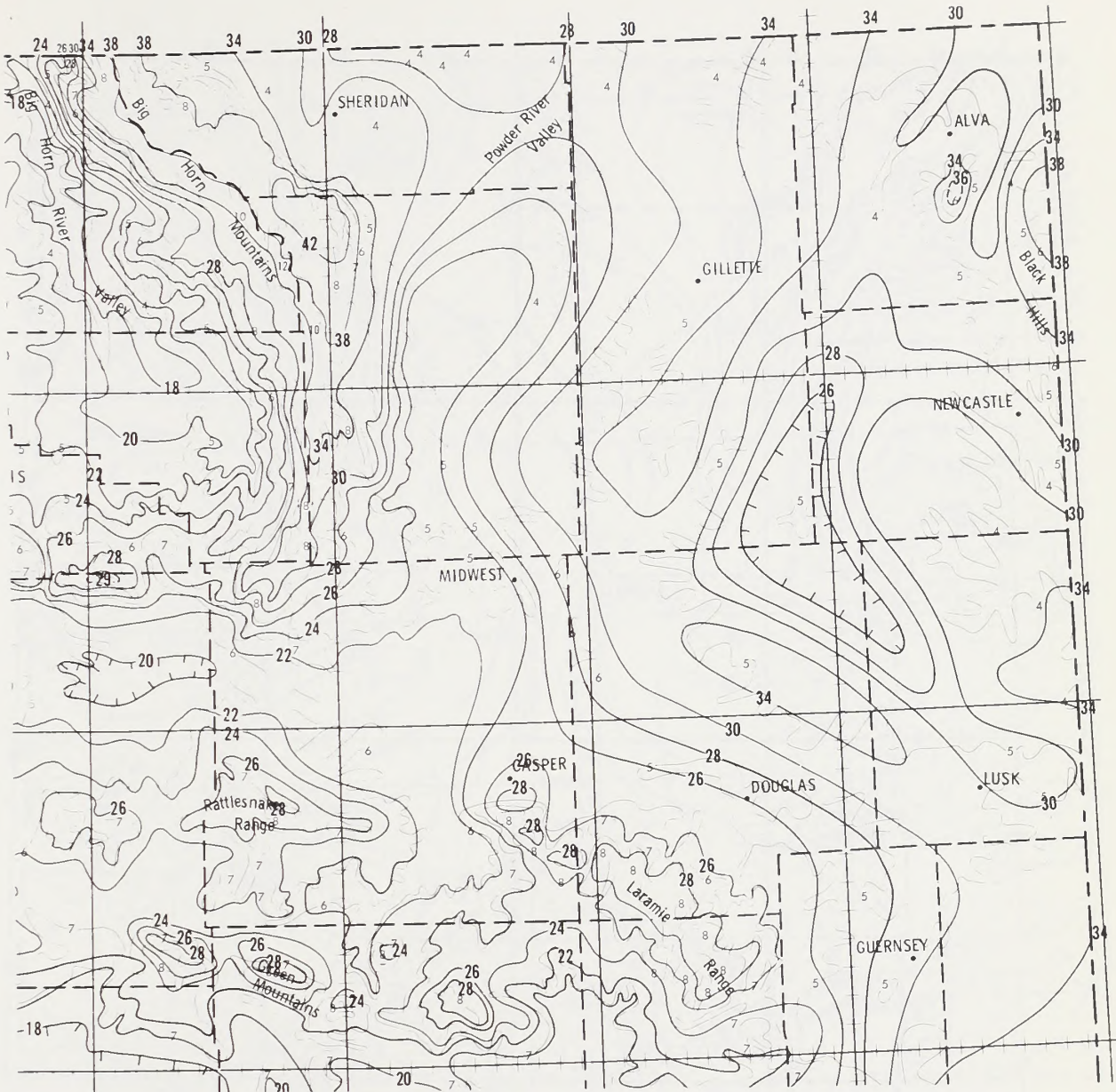
10 0 10 20 30 40
 SCALE IN MILES

LEGEND

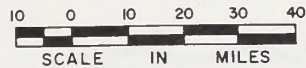
—26— Isopluvials of Precipitation
 in Tenths of an Inch Annual.

Figure 5

10 - Year 24-Hour Precipitation



Prepared by :
 U.S. Department of Commerce
 For :
 U.S. Department of Agriculture
 August 1968

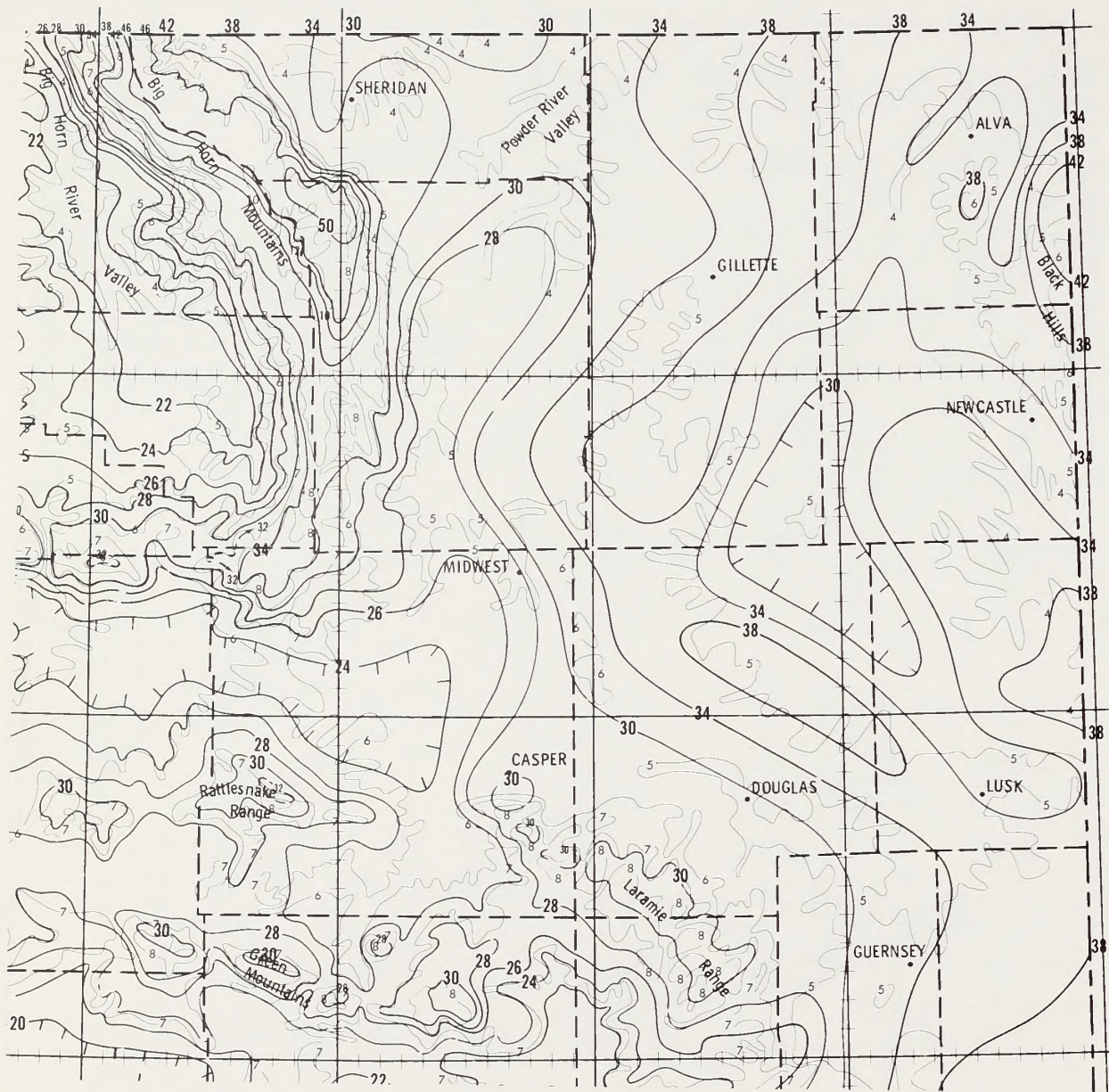


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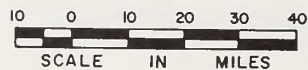
—26— Isopluvials of Precipitation
 in Tenths of an Inch Annual .

Figure 6

25 - Year 24-Hour Precipitation



Prepared by :
 U.S. Department of Commerce
 For :
 U.S. Department of Agriculture
 August 1968



LEGEND

—26— Isopleths of Precipitation
 in Tenths of an Inch Annual .

Figure 7

50 - Year 24-Hour Precipitation

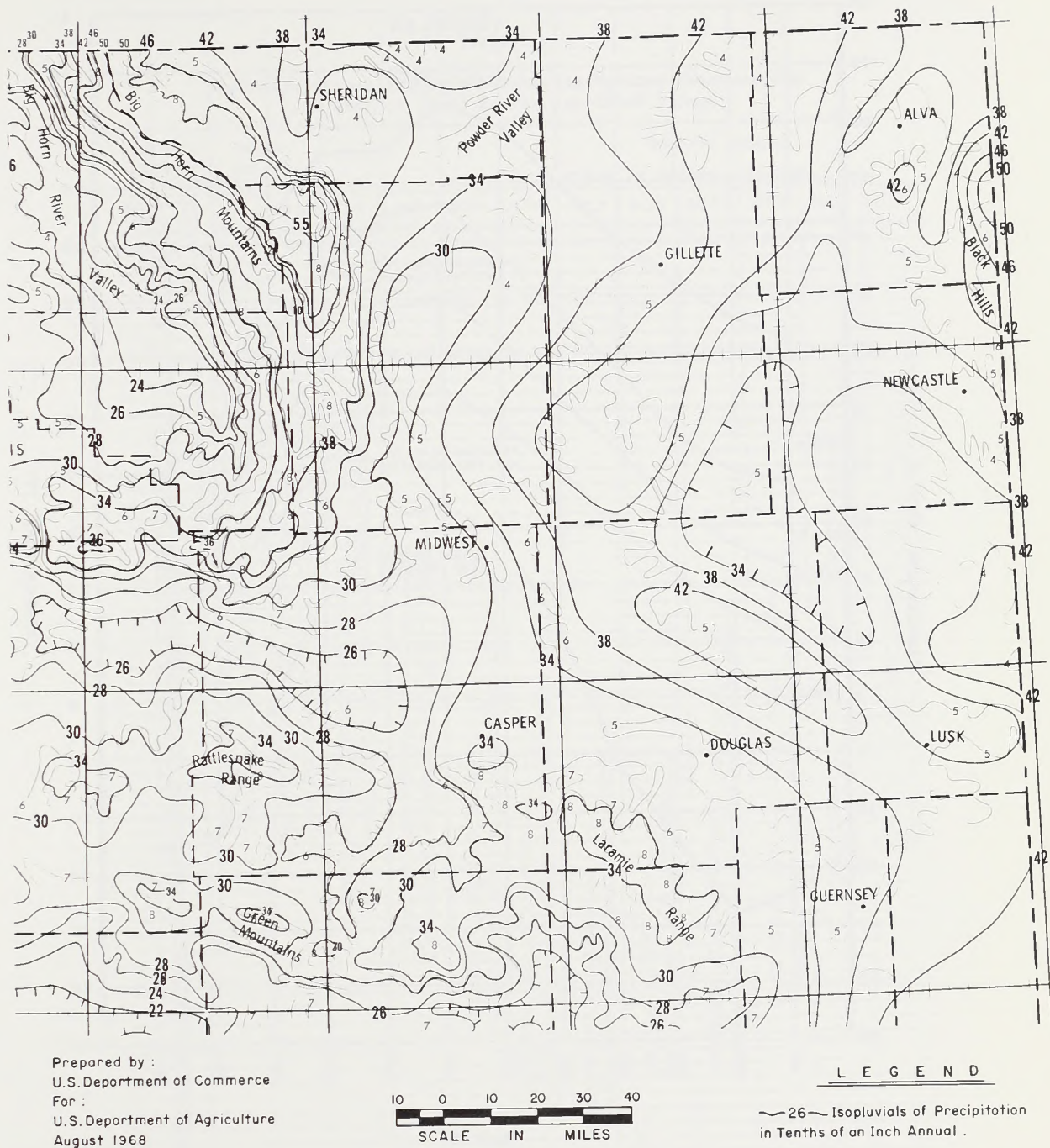


Figure 8

100 - Year 24-Hour Precipitation

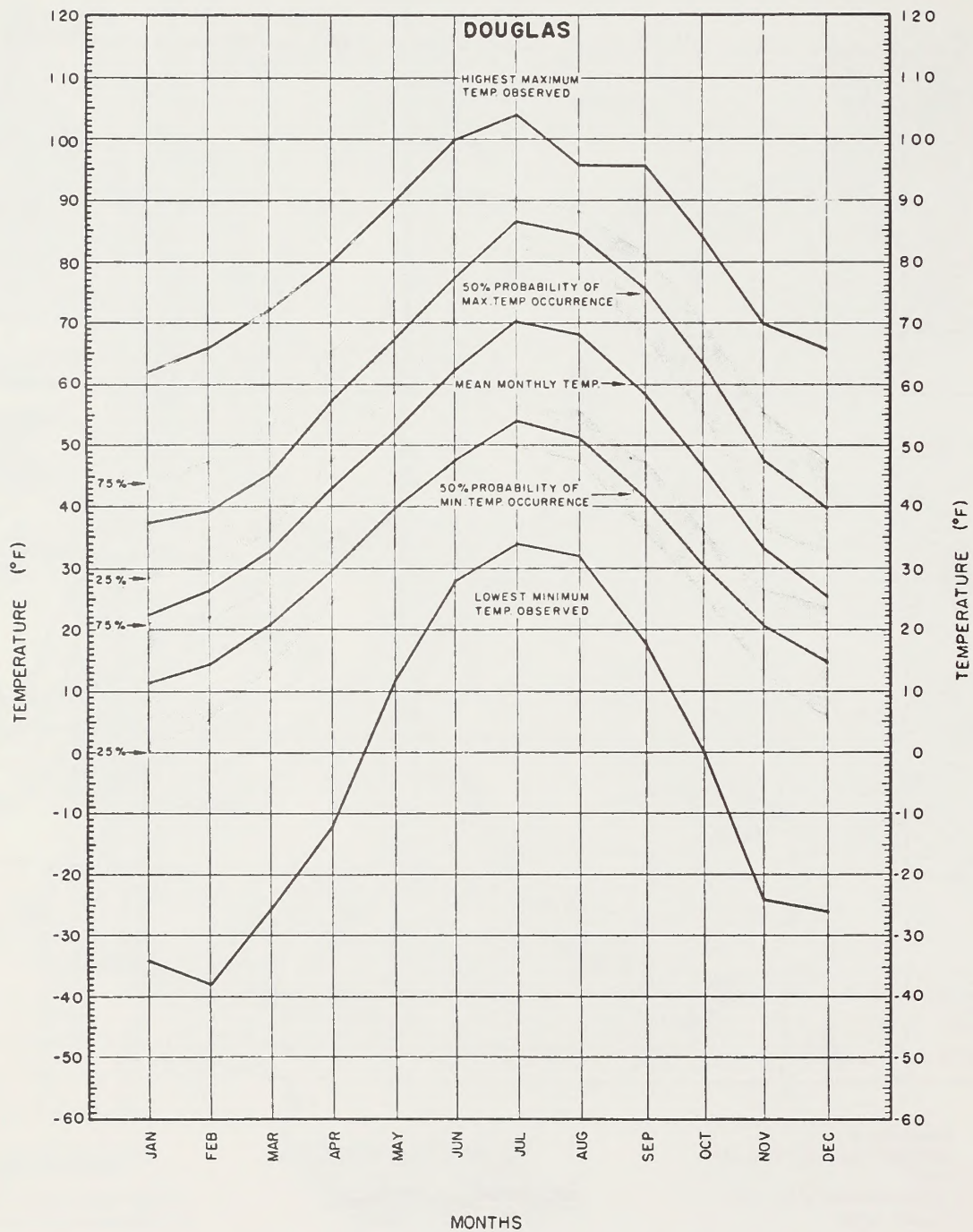


Figure 9

Probabilities of Minimum and Maximum Temperatures Less Than or Equal To Indicated Values, Monthly Mean, and Extreme Temperatures, Douglas

The intersection of the vertical lines for the various months with the temperature lines indicate the expected temperatures for the middle of the month.

Source: Clarence F. Becker and John D. Alyea. 1964. Temperature Probabilities in Wyoming. Bulletin 415. Laramie, Wyoming: Agricultural Experiment Station, University of Wyoming.

Table 5

**Empirical Probabilities of Observing Maximum Temperatures
Less Than or Equal To the Specified Values**

LATITUDE: 42° 46'	STATION: Douglas											
LONGITUDE: 105° 25'	PERIOD OF RECORD: 1931-1960											
ELEV. (GROUND): 4853 feet												
MAXIMUM TEMP. (°F)	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
-16												
-14												
-12												
-10	.10	.11										
-8	.10	.23										
-6	.32	.35										
-4	1.07	.47										
-2	1.18	.58										.21
0	1.93	.82									.11	.32
2	2.47	1.29									.11	.43
4	2.90	1.53	.10								.22	.64
6	3.54	2.12	.21								.22	.75
8	4.19	2.24	.53								.22	1.07
10	4.94	2.83	.96								.55	1.29
12	5.59	3.53	1.61								1.00	2.15
14	6.88	4.24	1.72	.11							1.33	3.01
16	8.17	4.95	2.36	.11							1.44	4.08
18	9.56	6.01	2.68	.11							2.22	5.16
20	12.04	7.90	3.33	.11							3.22	6.55
22	14.51	10.02	4.94	.11							3.88	9.24
24	17.31	13.08	6.34	.55							5.88	10.96
26	20.43	16.15	8.27	1.00						.10	8.00	13.22
28	23.54	20.63	10.96	1.00						.32	10.66	17.31
30	28.92	24.29	13.87	2.33	.10					.53	13.77	21.72
32	33.87	29.12	16.12	3.88	.43					1.18	17.66	26.23
34	39.13	35.14	19.89	6.44	.43					2.15	21.22	32.68
36	44.08	39.85	24.51	8.11	.53				.11	2.68	24.00	37.20
38	50.21	45.28	29.03	9.88	.86	.11			.33	3.22	27.77	43.22
40	58.06	51.41	33.97	12.44	1.39	.11			.55	4.83	31.55	50.64
42	65.48	58.25	38.49	14.77	2.15	.22			1.11	6.45	35.33	58.27
44	73.44	66.15	44.73	17.55	3.33	.22			1.66	9.35	41.44	66.02
46	81.50	70.75	51.39	22.11	5.05	.66			2.44	11.72	45.33	71.07
48	86.02	78.30	58.27	26.44	7.20	.66			2.88	14.73	51.33	77.20
50	91.07	82.90	64.19	29.77	9.24	1.11			3.77	17.09	57.88	82.58
52	93.54	88.08	69.24	35.00	12.04	1.44			4.77	20.10	63.77	88.17
54	96.77	90.56	75.59	41.55	14.73	2.66	.21	.10	6.33	23.87	70.11	92.15
56	98.38	92.68	80.32	46.66	19.24	3.55	.21	.10	7.00	28.60	75.88	94.83
58	99.13	95.63	86.55	52.11	23.33	4.55	.21	.21	9.00	32.90	82.11	96.77
60	99.46	97.52	90.75	58.55	28.17	6.44	.32	.43	11.44	38.70	87.66	98.38
62	99.89	98.82	93.11	62.66	33.44	9.00	.43	.86	14.55	45.91	91.55	99.46
64		99.29	95.59	70.77	40.86	13.11	.53	1.29	18.00	52.04	95.44	99.78
66		99.88	96.66	75.66	45.26	16.33	.53	1.82	21.00	58.27	97.55	99.89
68			97.95	81.00	53.33	20.44	.96	3.01	26.77	65.16	98.88	
70			98.81	87.66	63.01	25.88	2.25	4.40	32.11	72.15	99.55	
72			99.67	91.56	68.03	31.77	3.76	5.59	37.55	79.13		
74				94.55	75.91	37.55	6.02	9.35	44.44	86.02		
76				96.33	79.24	44.44	8.92	14.51	51.11	91.72		
78				98.33	84.83	51.11	12.79	20.75	59.66	95.26		
80				99.44	90.10	58.11	19.56	26.34	68.11	97.95		
82					93.01	66.44	27.41	34.51	77.66	99.35		
84					95.26	73.77	34.94	44.08	85.22	99.78		
86					97.52	79.44	46.66	57.52	89.66			
88					99.24	87.11	58.17	72.25	93.44			
90					99.89	92.22	70.64	83.01	96.55			
92						95.66	81.82	91.93	98.55			
94						98.33	90.21	96.88	99.55			
96						99.44	94.94	98.81	99.88			
98						99.55	96.88					
100						99.77	98.81					
102							99.35					
104							99.78					
106												
108												
110												
112												
114												

Source: Clarence F. Becker and John D. Alyea. 1964. Temperature Probabilities in Wyoming. Bulletin 415. Laramie, Wyoming: Agriculture Experiment Station, University of Wyoming.

Table 6

Empirical Probabilities of Observing Minimum Temperatures
Less Than or Equal To the Specified Values

LATITUDE: 42° 46'	STATION: Douglas											
LONGITUDE: 105° 25'	PERIOD OF RECORD: 1931-1960											
ELEV. (Ground): 4853 feet												
MINIMUM TEMP(°F)	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
-50												
-48												
-46												
-44												
-42												
-40												
-38		.11										
-36		.11										
-34	.10	.11										
-32	.10	.11										
-30	.43	.23										
-28	.64	.35										
-26	.86	.82	.10									.10
-24	1.18	1.29	.21								.11	.21
-22	1.82	2.00	.32								.22	.53
-20	2.90	2.71	.32								.44	.96
-18	4.30	3.18	.32								.55	1.29
-16	5.91	3.65	.64								.77	1.72
-14	7.74	4.83	.75								.88	2.25
-12	8.70	5.30	1.82	.11							1.33	3.54
-10	10.86	7.07	2.25	.11							1.88	4.73
-8	13.33	8.25	2.79	.11							2.11	5.91
-6	14.51	9.55	3.33	.11							3.22	7.74
-4	17.84	10.84	4.08	.44							4.11	9.78
-2	20.75	12.38	5.59	.66							5.33	12.47
0	24.94	16.50	7.09	.77						.10	7.77	16.34
2	27.74	19.33	8.49	.88						.10	9.55	18.70
4	32.04	22.87	10.00	.88						.21	12.22	22.04
6	36.55	27.12	11.93	1.00						.32	15.11	25.59
8	40.64	31.36	14.40	1.44						.53	17.55	30.86
10	46.12	35.96	18.70	2.00						.96	20.55	37.31
12	51.07	41.27	21.61	3.11	.10					1.50	24.00	43.11
14	57.31	49.41	26.02	4.33	.10					2.47	29.00	49.46
16	61.39	55.18	30.00	5.88	.32					3.65	33.77	53.11
18	66.55	60.84	36.66	8.77	.32				.11	4.30	40.22	58.81
20	72.04	68.39	44.51	12.00	.75				.55	7.74	47.22	65.37
22	77.09	74.29	52.25	17.44	1.39				1.00	11.72	54.77	70.96
24	83.01	79.24	62.68	23.66	2.25				1.66	17.74	63.11	77.74
26	87.52	83.83	70.96	32.11	3.97				2.55	25.16	72.11	82.36
28	92.04	88.32	77.52	40.88	5.91	.11			4.55	35.80	79.55	87.31
30	94.73	92.33	84.53	50.88	10.75	.33			8.55	48.38	85.11	90.75
32	96.23	95.28	90.10	62.22	18.49	1.77		.10	15.11	58.70	89.77	94.30
34	97.31	97.40	94.73	71.44	26.02	2.56	.10	.32	20.33	67.41	92.55	96.23
36	98.38	98.70	97.09	79.33	33.97	3.88	.32	.75	27.00	74.62	94.22	96.88
38	98.61	99.05	97.84	85.00	42.79	7.55	.96	2.04	36.11	80.64	96.33	97.52
40	99.45	99.41	99.03	90.11	54.08	13.00	1.62	3.44	45.00	86.88	97.88	98.17
42		99.64	99.56	94.11	64.51	20.11	2.90	5.91	53.44	90.64	99.33	98.92
44		99.88	99.67	97.22	75.80	30.00	4.83	5.89	63.11	94.62	99.77	99.03
46			99.78	98.77	84.73	40.66	8.70	17.63	70.66	96.77	99.88	99.67
48			99.89	99.33	91.39	54.00	14.94	26.55	77.77	98.38		99.78
50				99.77	94.94	64.77	25.05	38.06	83.22	99.03		99.89
52				99.88	97.09	74.11	36.12	50.10	88.44	99.56		
54					99.03	84.77	50.00	62.68	92.33	99.89		
56					99.67	90.00	62.68	75.16	95.77			
58					99.89	94.88	75.37	83.76	97.77			
60						97.33	86.45	91.50	99.33			
62						98.77	93.22	95.59	99.88			
64						99.44	96.98	97.52				
66						99.66	98.70	99.03				
68							99.35	99.78				
70							99.78					
72							99.89					
74												
76												
78												
80												

Source: Clarence F. Becker and John D. Alyea. 1964. Temperature Probabilities in Wyoming. Bulletin 415. Laramie, Wyoming: Agricultural Experiment Station, University of Wyoming

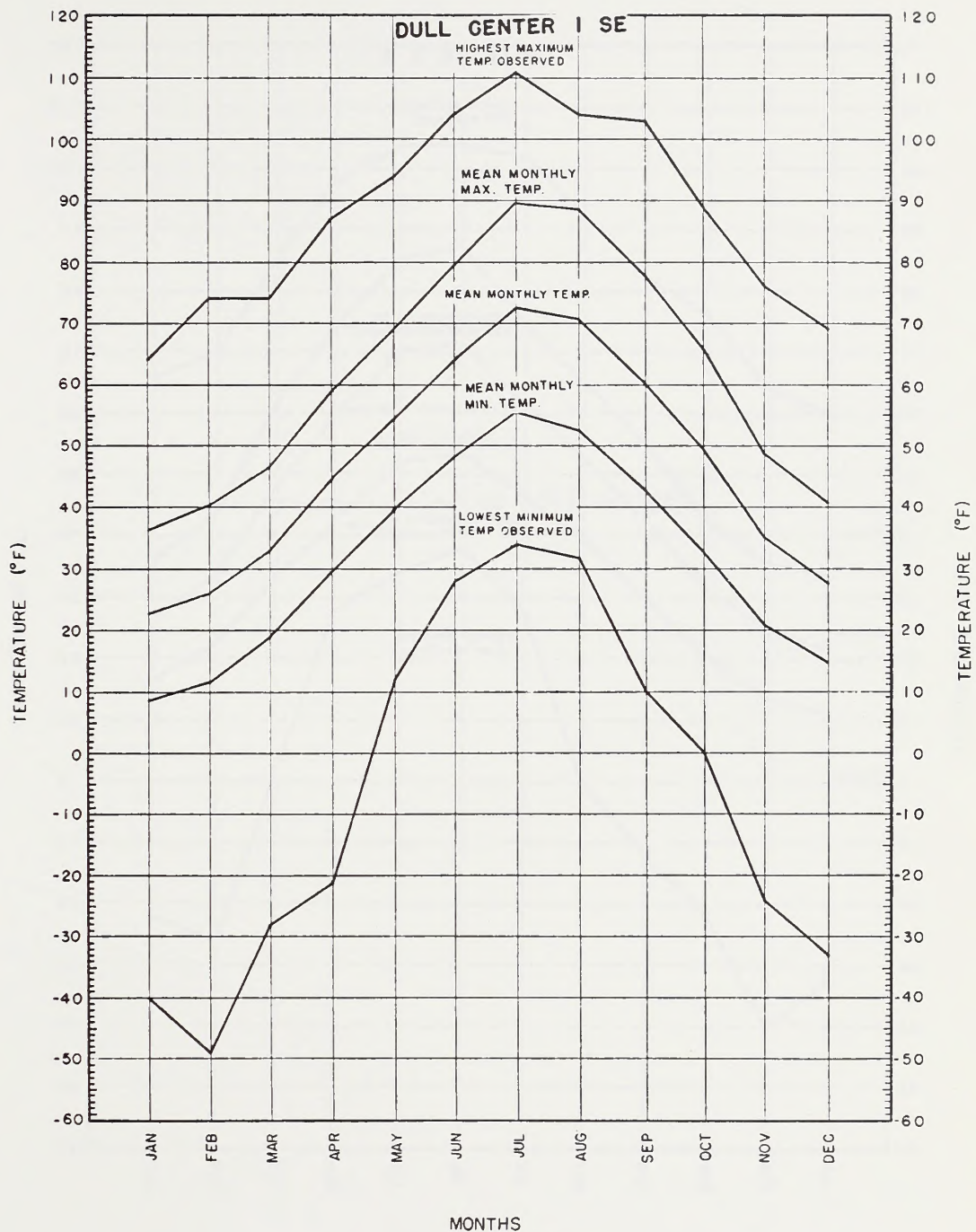


Figure 10

Probabilities of Minimum and Maximum Temperatures Less Than or Equal To Indicated Values, Monthly Mean, and Extreme Temperatures, Dull Center

The intersection of the vertical lines for the various months with the temperature lines indicate the expected temperatures for the middle of the month.

Source: Clarence F. Becker and John D. Alyea. 1964. Temperature Probabilities in Wyoming. Bulletin 415. Laramie, Wyoming: Agricultural Experiment Station, University of Wyoming.

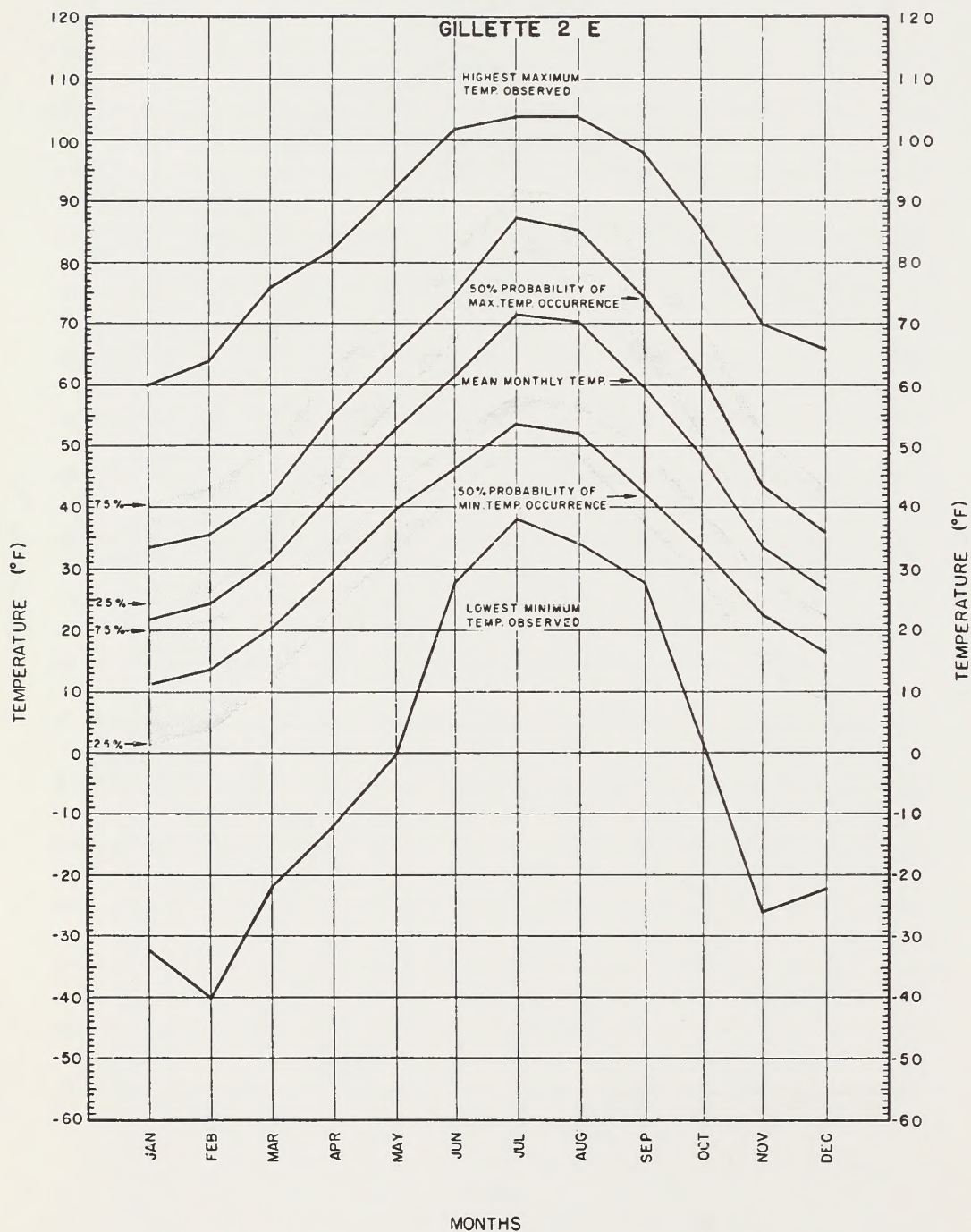


Figure 11

Probabilities of Minimum and Maximum Temperatures Less Than or Equal To Indicated Values, Monthly Mean, and Extreme Temperatures, Gillette

The intersection of the vertical lines for the various months with the temperature lines indicate the expected temperatures for the middle of the month.

Source: Clarence F. Becker and John D. Alyea. 1964. Temperature Probabilities in Wyoming. Bulletin 415. Laramie, Wyoming: Agricultural Experiment Station, University of Wyoming.

APPENDIX B

Glossary - Selected Bibliography

GLOSSARY

This glossary is included as an aid to reader understanding of the statement. It includes technical words that may not be common in popular use and also more common words that, in this report, may be used in a more narrow, technical way.

AASHTO classification (soil engineering). The official classification of soil materials and soil aggregate mixtures for highway construction used by the American Association of State Highway Officials.

Acre-foot. The quantity of a material that will cover 1 acre of land 1 foot deep.

Aestivate. To pass the summer in a dormant state. Summertime hibernation.

Agglomerate. To fuse into a mass.

Alkaline soil. Precisely, any soil horizon having a pH value greater than 7.0; practically, a soil having a pH above 7.3.

Alkali soil. 1: A soil with a high degree of alkalinity (pH of 8.5 or higher) or with a high exchangeable sodium content (15 percent or more of the exchange capacity) or both. 2: A soil that contains sufficient alkali (sodium) to interfere with the growth of most crop plants.

Alluvial soils. An azonal great soil group developed from transported and relatively recently deposited material (alluvium) characterized by a weak modification (or none) of the original material by soil-forming processes.

Alluvium. Clay, silt, sand, and gravel or other rock material transported by flowing water and deposited as sorted or semi-sorted sediments.

Ammonium nitrite fuel-oil prill. A globular, porous particle obtained by spraying ammonium nitrate and fuel oil in a rising current of warm air. Used in blasting.

Angle of repose. Angle between the horizontal and the maximum slope that a soil assumes through natural processes.

Animal unit month. A measure of forage or feed requirement to maintain one animal (cow or 5 sheep) for a period of 30 days. Abbreviated: AUM.

Annual plant. A plant that completes its life cycle and dies in one year or less.

Aquifer. A layer of rock, sand, or gravel that contains water and that will deliver it in usable quantities to wells.

Aquifer skeleton. The mineral framework of a water-bearing zone or aquifer.

Atmospheric stability. The degree of vertical mixing of the air. It is a measure of the potential ability of air to diffuse pollutants both laterally and vertically.

Available water-holding capacity (soils). The capacity to store water available for use by plants, usually expressed in linear depths of water per unit depth of soil.

Backfill. The process of filling, or the material used to fill, a surface mine pit.

Bedrock. The more or less solid rock in place either on or beneath the surface of the earth.

Belt conveyor. A moving, endless belt that rides on rollers and on which materials can be carried for various distances.

Belt line. A belt conveyor.

Bench. A division of a coalbed. A layer in a coalbed mined separately.

Biome. A major biotic unit consisting of plant and animal communities having similarities in form and environmental conditions.

Boxcut. The initial pit in a strip mine where no open side exists; this results in a highwall on both sides of the pit.

Breaks. Rough, broken topography--in many places the transition area between highlands and lowlands.

Browse. That part of leaf and twig growth of shrubs, woody vines, and trees available for animal consumption.

Btu. Abbreviation for the British thermal unit. Amount of heat needed to raise 1 pound of water 1 degree F (252 calories).

Burn area. Area of clinker.

Burnline. Rock outcrop of hard clinker produced by a burning coalbed.

Carbonaceous. Containing carbon. Shale or other rock containing small fragments of carbon distributed throughout.

Carnivorous. Flesh eating.

Carrying capacity. A maximum number of animals that can survive on a land area over the long term.

Channery. Soil mass containing between 15 and 90 percent by volume of fragments.

Claystone. Hardened clay.

Clinker. Natural baked shale--in the study area it normally overlies burned out coal seams and was formed by burning of the coal. Locally called scoria.

Coal. A solid, brittle, dark brown to black, combustible, carbonaceous rock formed by the partial to complete decomposition of vegetation.

Coal slack. Fine-grained coal resulting from weathering and exposure to air.

Coke. Coal from which volatile constituents have been driven off by heat, so that the fixed carbon and ash are fused together.

Colluvium. Loose, unconsolidated clay, silt, sand, and gravel at the foot of a slope, brought there by force of gravity.

Community. An aggregate of organisms which form a distinct ecological unit. Such a unit may be defined in terms of plants, animals, or both.

Concretion. An accumulation of mineral matter cemented around a center within a sedimentary host rock, commonly spheroidal or disk-shaped.

Contour furrows. Furrows plowed approximately on the contour on pasture or rangeland to prevent soil loss and increase infiltration. Also, furrows laid out approximately on the contour for irrigation purposes.

Corrosion (of rock). The solution of rocks and other materials by chemical action.

Coulee. A steep-walled valley or ravine varying widely in size and often having a stream at the bottom.

Crop out. To be exposed at the surface.

Cover, vegetative. All plants found on an area, irrespective of whether they have forage or other value. Syn.: plant cover.

Dip. The angle at which a bed or stream is inclined from the horizontal.

Discharge. The process by which water moves from an aquifer, or the amount of water that moves from an aquifer.

Dissolved solids. The total dissolved mineral constituents of water.

Diversion terrace. Channels across a hillside used to protect bottomland from hillside runoff or to protect against runoff from an untterraced area.

Dragline. A type of excavating equipment which casts a rope-hung bucket and collects dug material by pulling the bucket with a second rope.

Dry farming. Farming without irrigation.

Ecology. A study of animals and plants in their relation to each other and to their environment.

Ecosystem. Complex self-sustaining natural system which includes living and nonliving components of the environment and the interactions that bind them together. Its functioning involves the circulation of matter and energy between organisms and their environment.

Ecotone. Transition zone between two adjacent plant or animal communities.

Ecotype. A locally adapted population of a species which has a distinctive limit of tolerance to environmental factors.

Effluent. A liquid or gaseous product discharged from the ground, or a process.

Eolian soil material. Soil material accumulated through wind action.

Erodible. Susceptible to erosion. (Expressed by terms such as highly erodible, slightly erodible, etc.)

Exotic. Not native, usually from another continent.

Fauna. The animals of a particular period or region taken collectively.

Final highwall. The final face of exposed overburden and coal or ore in a surface mine.

Flow net. A graphic representation of the flow lines and equipotential lines used in the study of seepage.

Food chain. The pattern of energy or food transfer between a series of organisms interrelated in their feeding habits within an ecosystem. One organism is fed upon by another which in turn is fed upon by another, etc.

Forb. Any herbaceous plant other than those that are grass or grass-like.

Formation. A distinctive group of rocks selected as a convenient unit for mapping, description, and reference.

Friable. Easy to break, crumbling naturally, poorly cemented so as to crumble.

Geomorphology. That branch of both physiography and geology that deals with the form of the earth, the general configuration of its surface, and the changes that take place in the evolution of landforms.

gpd. Gallons per day.

gpm. Gallons per minute.

Ground water. Atmospheric water which saturates rock openings at and beneath the water table. Also used to mean all water below the ground surface.

Habitat. A specific set of physical conditions that surround the single species, a group of species, or a large community. In wildlife management, the major components of habitat are considered to be food, water, cover, and living space.

Herbivorous. Plant eating.

Highwall. The unexcavated face of exposed overburden and coal in a strip mine pit.

Hydrophyte. A plant that grows in water or in wet or saturated soils.

Infrastructure. Those public services and facilities necessary for the existence of a town and normally supported by public funds, such as schools, roads, medical services and facilities.

Insectivorous. Insect eating.

Intermittent stream. A stream that flows only part of the time.

Invertebrate. An animal without a backbone. This group includes such animals as insects, clams, snails, worms, and others.

Isogram. A line connecting points of equal value with regard to certain variables.

Isopach. A line connecting points of equal or corresponding thickness.

Isopleth. A line connecting points of equal or corresponding values with regard to certain chemical elements.

Landform. A discernible natural landscape, such as a floodplain, stream terrace, plateau, valley, etc.

Lignite. A brownish-black coal in which the alteration of vegetable material has not progressed as far as subbituminous coal.

Limiting factor. A critical living or nonliving element of an ecosystem necessary for an organism to survive that is in the least supply.

Long ton. A unit of weight that equals 2,240 pounds.

Member. A division of a formation generally of distinct lithology.

Mesophyte. A plant that grows under intermediate moisture conditions.

Mg/l. Abbreviation for milligrams per liter, the unit of expression for the concentration of dissolved minerals in water.

Miscellaneous land type. Areas of land that have little or no natural soil or that are too nearly inaccessible for orderly examination or that occur where, for other reasons, it is not feasible to classify the soil.

Mixing height. Thickness of the mixing layer (see below).

Mixing layer. In air pollution terminology, the layer of air, usually a subinversion layer, within which pollutants are mixed by turbulence and diffusion.

Mollusks. An invertebrate group which includes snails, clams, chitins, and others.

Nonagglomerating. Will not agglomerate.

Noncoking. Will not coke.

Opencast method. A mining method which consists in removing the overlying rock or overburden, extracting the coal, and then replacing the overburden.

Overburden. Rock or unconsolidated material overlying a coalbed, excavated during strip mining.

Parting. A band of waste material dividing the coal layers.

Passerine. Small or medium sized, chiefly perching song birds, having grasping feet with the first toe directed backwards.

Perennial. Having a life cycle that lasts more than two years.

Perennial stream. A stream that flows all the time.

Permeability, soil. The quality of a soil horizon that enable water or air to move through it.

Physical properties (of soils). Those characteristics, processes, or reactions of a soil which are caused by physical forces and which can be described by, or expressed in, physical terms or equations.

Playa. A shallow central basin of a plain where water gathers after a rain and is evaporated.

Potentiometric surface. An imaginary surface that coincides with the static level of water in an aquifer.

Prill. A globular, porous particle obtained by spraying a solution of ammonium nitrate into a rising current of warm air.

Proximate analysis. The determination of the compounds in a coal.

R. Range, one of the north-south rows of townships in a U.S. public-land survey.

Rank. The place occupied by a coal in a classification. A term used to indicate the position of a coal in the series peat to anthracite.

Raptorial. An order of birds including all the birds of prey such as the eagle, hawk, owl, and vulture.

Recharge. The process by which water moves into an aquifer, or the amount of water that moves into an aquifer.

Reclamation. Restoration of mined or disturbed land; rehabilitation.

Rehabilitation. Restoration of mined or disturbed land; reclamation.

Reserves. Known deposits of coal that can be profitably mined. Tonnage generally known within 20 percent.

Resources. Includes reserves and other coal deposits that may become profitable to mine. Tonnage imperfectly known.

Riparian. Situated on or pertaining to the bank of a river, stream, or other body of water.

Road metal. Rock suitable for surfacing dirt and macadamized roads and for foundations for asphalt and concrete roadways.

Rough broken land. Land with very steep topography and numerous intermittent drainage channels but usually covered with vegetation.

Rs. Plural of range.

Saline-alkali soil. A soil containing sufficient exchangeable sodium to interfere with the growth of most crop plants and containing appreciable quantities of soluble salts.

Saline soil. A nonalkali soil containing sufficient soluble salts to impair its productivity but not containing excessive exchangeable sodium.

Sandstone. A cemented or compacted sedimentary rock composed usually of grains of quartz.

Scarified. The breaking with a machine of hard soil material or spoil in strip mine reclamation.

Scoria. Local term for natural baked shale--see "clinker."

Scoria land. Areas of slaglike clinkers, burned shale, and fine-grained sandstone; characteristic of burned-out coalbeds.

Sec. A parcel of land that is 1 square mile or 640 acres. Known as a section.

Secs. Plural of sec. or section.

Semiarid. A term applied to regions or climates where moisture is normally greater than under arid conditions but still definitely limits the growth of most crops.

Shale. A fine-grained sedimentary rock.

Shale parting. A layer of shale separating benches of coal.

Short ton. A unit of weight that equals 2,000 pounds.

Siltstone. A sedimentary rock composed of grains intermediate in size between clay and sand.

Slope wash. Soil and rock material that has been moved down a slope by gravity and running water and not concentrated in a channel.

Slurry. A mixture of fine coal in water. Commonly pumped through pipelines at processing plants or to consumption points.

Soil association. A group of defined and named soil units occurring together in an individual and characteristic pattern over a geographic region, comparable to plant associations in many ways.

Soil material. Soils leached free of soluble salts and capable of sustaining plant growth and recognized as such by standard authorities.

Soil series. A group of soils having horizons similar in characteristics and arrangement in the soil profile, except for texture of the surface portion.

Solute. A substance dissolved in a solution, as distinguished from the solvent.

Spoil. The overburden removed in strip mining. Debris or waste material from a strip mine.

Stagnation episode. Meteorological conditions, generally temperature inversions, lasting from two to five days during which air pollutant concentrations increase, resulting in one or more of the following effects: reduced visibility, damage to vegetation and animals, coughing and eye irritation, increased morbidity, and increased mortality.

Subbituminous coal. Nonagglomerating coal having a heat value of 8,300 to 13,000 Btu on a moist, mineral-matter-free basis. Intermediate in rank between lignite and bituminous coal.

Succession. The progressive development of vegetation toward its highest ecological expression, the climax; replacement of one plant community by another.

T. Township, a tract of land that is bounded on the east and west by meridians six miles apart at its south border, has a north-south length of six miles, and forms one of the chief divisions of a U.S. public-land survey.

Temperature inversion. A layer in which temperature increases with altitude. The principal characteristic of an inversion layer is its marked static stability, within which very little turbulent exchange can occur.

Terrace. An embankment or combination of an embankment and channel constructed across a slope to control erosion by diverting or storing surface runoff instead of permitting it to flow uninterrupted down the slope.

Throwing radius. The radius through which a dragline can dig, rotate, and deposit material. It is dependent on the length of the dragline's boom.

Topsoil. As used for mined area spoil reclamation, topsoil refers to the A horizons, and those portions of the B and C horizons, that are favorable for the growth of plants. For the railroad right-of-way, it refers to the A horizons only.

Tps. Townships.

Transpiration. The process by which water moves from living plants to the atmosphere.

Ultimate analysis. The determination of the percentage of constituent elements of a chemical substance such as coal.

Unified Soil Classification System (engineering). A classification system based on the identification of soils according to their particle size, gradation, plasticity index, and liquid limit.

Unit train. A train made up entirely of coal cars carrying coal directly from the loading place to point of delivery.

Upland. An extensive region of highland in the interior of the country; higher land in contrast to valley, plain, or other low-lying land; a plateau.

Vertebrate. All animals having a segmented spinal column.

Water table. Generally considered to be near the top of the zone of saturation in an unconfined aquifer, but this water level in a well may fluctuate in response to several factors.

Wind rose. A diagram designed to show the distribution of wind direction recorded at a given location over a period of time.

Working pit. The place at a mine from which coal is actually being extracted.

Table 7

**Empirical Probabilities of Observing Minimum Temperatures
Less Than or Equal To the Specified Values**

LATITUDE: 44° 17'
 LONGITUDE: 105° 28'
 ELEV. (Ground): 4556 feet

STATION: Gillette 2E

PERIOD OF RECORD: 1931-1960

MINIMUM TEMP(°F)	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
-50												
-48												
-46												
-44												
-42												
-40		.11										
-38		.11										
-36		.11										
-34		.11										
-32	.10	.35										
-30	.21	.47										
-28	.43	.94										
-26	.53	1.41									.11	
-24	1.07	1.88									.11	
-22	2.15	1.88	.21								.22	.32
-20	3.44	2.24	.21								.44	.53
-18	4.19	3.18	.32								.55	.75
-16	5.59	3.77	.75								.66	1.18
-14	7.20	4.71	1.29								.77	1.93
-12	9.03	5.07	1.93	.11							.88	3.01
-10	12.47	6.25	2.47	.11							1.44	4.19
-8	13.75	8.01	3.01	.11							1.66	4.51
-6	15.37	10.02	3.87	.11							1.66	5.26
-4	17.74	12.02	5.48	.33							3.11	7.41
-2	20.32	15.33	6.66	.44							4.00	9.24
0	23.87	19.45	8.38	.44	.10					.10	5.66	12.25
2	26.34	21.93	9.89	.77	.10					.21	6.66	14.62
4	30.53	25.11	12.15	1.00	.10					.21	8.55	16.23
6	33.76	28.30	13.54	1.11	.10					.43	9.88	19.13
8	38.81	31.36	16.12	1.66	.10					.43	12.11	23.33
10	44.40	38.67	21.50	2.55	.21					.64	17.00	29.89
12	50.32	43.86	26.02	4.66	.21					1.18	20.77	37.41
14	56.23	50.35	29.78	6.77	.32				.22	1.72	25.22	45.69
16	60.21	55.89	31.93	8.11	.32				.22	2.58	27.22	48.49
18	66.12	61.20	37.20	10.44	.43				.33	3.76	32.66	55.37
20	74.94	69.33	47.74	14.44	.64				.44	6.12	39.88	66.12
22	81.39	76.65	56.66	20.77	1.29				.99	8.81	46.88	72.79
24	86.02	82.54	66.45	26.88	2.68				1.44	13.87	56.55	79.46
26	90.75	85.96	73.76	33.00	3.97				2.33	18.60	63.22	84.83
28	93.76	89.38	80.32	43.88	6.66	.22			3.55	24.94	71.00	88.70
30	96.55	93.51	88.49	54.33	12.79	.88			5.54	33.54	82.22	92.90
32	97.95	95.99	92.04	63.11	18.70	1.77			8.87	42.90	88.22	95.91
34	98.81	98.23	94.94	73.33	26.98	3.33		.21	14.65	52.58	92.55	97.41
36	99.56	99.05	96.55	78.55	34.40	5.11		.21	20.31	59.46	95.44	98.49
38	99.56	99.29	97.84	84.88	42.58	8.33	.10	.96	26.74	68.06	97.66	98.92
40	99.89	99.76	98.81	90.77	55.69	15.88	1.18	2.79	36.73	78.27	99.33	99.46
42			99.67	94.33	66.66	24.55	2.90	4.83	46.61	86.23	99.44	99.78
44			99.78	97.00	78.27	36.55	4.94	8.60	55.71	91.93	99.55	
46				99.11	85.91	48.00	8.17	13.97	62.81	95.05	99.88	
48				99.55	90.75	58.66	12.04	20.75	70.81	97.31	99.88	
50				99.77	94.51	69.88	23.54	33.44	78.46	98.60		
52				99.77	96.45	79.88	33.01	45.59	85.57	99.13		
54				99.88	98.27	87.22	45.59	57.74	90.12	99.78		
56					98.92	93.88	56.98	71.07	93.67	99.78		
58					99.46	96.77	70.21	80.21	96.00	99.89		
60					99.89	98.88	81.72	87.64	98.00	99.89		
62						99.55	89.89	93.22	99.33			
64						99.88	95.48	96.77	99.88			
66						99.88	97.31	98.17				
68						99.88	98.70	99.24				
70							99.67					
72							99.67					
74												
76												
78												
80												

Source: Clarence F. Becker and John D. Alyea. 1964. Temperature Probabilities in Wyoming. Bulletin 415. Laramie, Wyoming: Agriculture Experiment Station, University of Wyoming.

Table 8

**Empirical Probabilities of Observing Maximum Temperatures
Less Than or Equal To the Specified Values**

LATITUDE: 44° 17'
 LONGITUDE: 105° 28'
 ELEV. (GROUND): 4556 feet

STATION: Gillette 23

PERIOD OF RECORD: 1931-1960

MAXIMUM TEMP.(°F)	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
-16	.32	.11										
-14	.43	.35										
-12	.43	.58										
-10	.75	.70										
-8	1.39	.94										.32
-6	1.39	1.17										.32
-4	1.82	1.41										.43
-2	2.04	1.53									.33	.43
0	3.65	1.76	.21								.33	.53
2	4.51	2.12	.43								.33	.53
4	5.59	2.59	.75								.44	.86
6	5.91	3.41	1.18								.55	1.50
8	6.77	4.36	1.39	.11							.77	1.72
10	9.35	5.66	1.82	.11							1.33	2.58
12	10.32	6.48	2.58	.22							2.11	3.65
14	12.68	7.78	3.11	.22						.10	2.88	5.37
16	13.76	8.96	3.44	.33						.21	3.22	5.69
18	15.26	10.96	4.62	.33						.21	4.22	7.63
20	18.49	14.15	5.59	.44						.21	5.11	10.53
22	20.86	16.39	7.41	.44						.32	5.66	12.68
24	24.83	20.40	9.35	.77						.32	8.00	15.16
26	28.49	23.93	11.18	1.22						.43	9.55	17.63
28	31.93	28.06	14.73	2.11					.22	.53	12.88	22.79
30	37.63	34.66	19.89	2.77	.21				.22	.86	16.44	29.03
32	42.79	38.20	23.33	4.33	.21				.22	1.29	19.00	33.87
34	50.86	45.40	28.81	7.22	.43				.22	2.47	26.33	41.82
36	57.09	51.29	33.44	9.22	.75				.22	3.01	28.66	47.84
38	63.65	57.19	38.49	11.77	1.07	.11			.44	4.73	35.77	53.54
40	71.50	66.62	46.45	16.44	1.93	.22			1.10	6.88	40.44	62.58
42	79.56	71.93	53.01	19.33	2.90	.22			1.44	9.67	45.11	70.53
44	86.34	77.24	59.03	22.77	5.05	.77			1.99	12.79	51.22	77.63
46	90.10	81.25	64.19	26.00	6.77	.77			2.44	14.19	56.77	83.44
48	94.08	85.61	69.03	30.44	8.60	1.00	.10		3.32	16.77	61.22	86.98
50	96.23	89.03	76.34	36.55	12.36	1.66	.10		4.10	22.68	69.11	91.61
52	98.17	91.39	80.00	42.11	14.94	2.55	.10		5.66	26.02	73.66	94.40
54	99.24	94.45	84.40	47.77	18.38	4.44	.10		6.88	29.46	79.44	96.66
56	99.67	95.99	87.52	51.77	21.39	6.00	.21	.21	8.32	34.40	83.77	97.95
58	99.67	97.52	90.32	58.11	26.77	9.00	.21	.21	10.76	38.06	86.22	98.60
60	99.89	98.11	93.33	65.33	33.97	12.33	.32	.43	14.53	43.33	90.44	99.56
62		99.29	95.16	71.55	40.43	15.00	.64	.53	16.98	47.84	93.66	99.67
64		99.76	97.31	76.77	45.59	18.55	1.39	2.04	21.42	54.94	96.22	99.78
66			97.95	81.00	50.86	22.22	1.50	3.11	25.08	60.00	97.33	99.78
68			98.60	86.22	58.27	27.88	2.04	3.87	29.41	65.26	98.44	
70			99.24	91.33	66.45	33.22	5.16	6.12	35.84	72.90	99.77	
72			99.89	94.11	73.01	39.22	6.02	8.81	40.17	78.60		
74			99.89	96.22	79.03	47.22	8.49	11.82	47.61	85.37		
76			99.89	98.00	83.33	52.88	11.39	14.08	53.71	89.56		
78				98.88	87.95	59.88	15.59	19.78	59.26	93.11		
80				99.66	91.39	68.33	20.21	26.88	65.70	96.77		
82				99.88	93.87	74.66	25.59	33.76	71.92	98.60		
84					96.23	81.55	34.08	42.68	80.02	99.35		
86					97.52	87.77	42.25	50.21	86.12	99.89		
88					98.70	91.77	51.93	57.31	90.56			
90					99.35	95.22	64.51	69.56	94.45			
92					99.89	96.77	74.83	79.78	96.11			
94						98.33	83.97	90.86	98.44			
96						99.11	90.32	94.62	99.77			
98						99.77	94.40	97.84				
100						99.77	97.74	99.03				
102						99.88	99.35	99.67				
104							99.89	99.89				
106												
108												
110												
112												
114												

Source: Clarence F. Becker and John D. Alyea. 1964. Temperature Probabilities in Wyoming. Bulletin 415. Laramie, Wyoming: Agriculture Experiment Station, University of Wyoming.

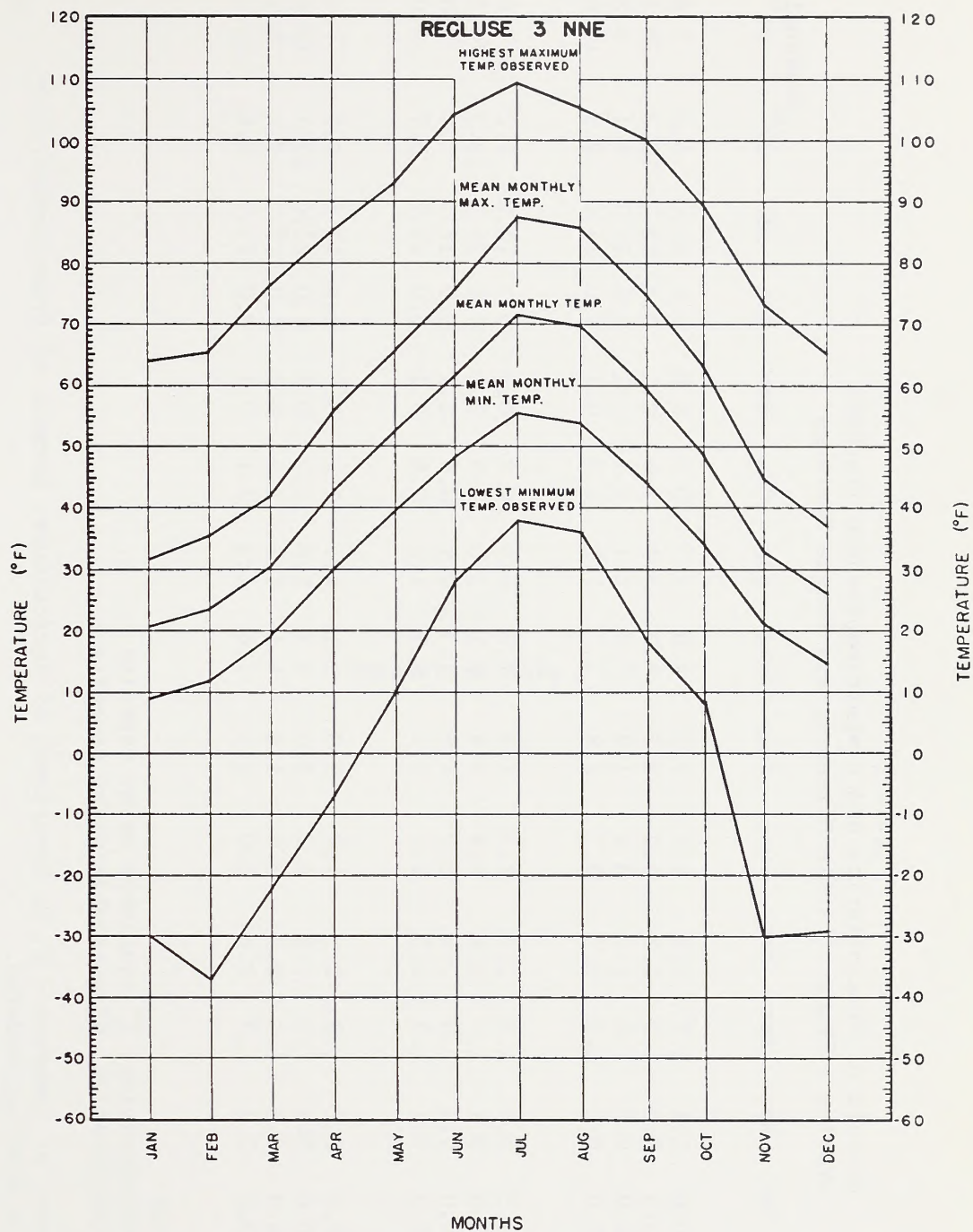


Figure 12

Probabilities of Minimum and Maximum Temperatures Less Than or Equal To Indicated Values, Monthly Mean, and Extreme Temperatures, Recluse

The intersection of the vertical lines for the various months with the temperature lines indicate the expected temperatures for the middle of the month.

Source: Clarence F. Becker and John D. Alyea. 1964. Temperature Probabilities in Wyoming. Bulletin 415. Laramie, Wyoming: Agriculture Experiment Station, University of Wyoming.

Table 9

Normals of Precipitation and Evapotranspiration (inches)
Wyoming - Powder, Little Missouri, and Tongue Drainage

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	ANN	32°	Seasonal 28°
<u>Gillette 2E</u>															
P	0.6	0.6	1.1	1.7	2.2	2.6	1.2	1.0	1.1	0.7	0.8	0.6	14.0	6.4	7.8
PET	0.0	0.0	0.0	1.2	2.8	4.0	5.7	5.0	3.1	1.6	0.1	0.0	23.5	18.3	20.5
E _a (2)	0.0	0.0	0.0	1.2	2.7	3.4	1.9	1.0	1.1	0.7	0.1	0.0	12.1	8.1	9.8
E _a (6)	0.0	0.0	0.0	1.2	2.7	3.5	2.9	1.7	1.3	0.8	0.1	0.0	14.0	9.9	11.6
<u>Dull Center 1SE</u>															
P	0.2	0.3	0.6	1.5	2.3	2.2	1.5	1.2	0.9	0.8	0.4	0.3	12.2	6.2	7.4
PET	0.0	0.0	0.1	1.3	2.9	4.4	5.9	5.1	3.0	1.5	0.1	0.0	24.3	18.2	20.3
E _a (2)	0.0	0.0	0.1	1.3	2.8	3.0	1.9	1.3	0.9	0.8	0.1	0.0	12.2	7.6	9.0
E _a (6)	0.0	0.0	0.1	1.3	2.5	2.7	2.1	1.5	1.0	0.8	0.1	0.0	12.2	7.7	9.0
<u>Douglas</u>															
P	0.4	0.5	0.8	1.8	2.3	1.8	1.3	1.1	1.1	1.1	0.6	0.6	13.5	5.7	7.2
PET	0.0	0.0	0.1	1.3	2.8	4.2	5.4	4.7	2.9	1.4	0.1	0.0	23.0	17.1	19.4
E _a (2)	0.0	0.0	0.1	1.3	2.7	3.0	1.8	1.1	1.1	1.1	0.1	0.0	12.3	7.4	9.1
E _a (6)	0.0	0.0	0.1	1.3	2.6	3.0	2.5	1.6	1.3	1.1	0.1	0.0	13.5	8.6	10.2

P = Precipitation

PET = Evapotranspiration

E_a(2) = Actual evapotranspiration, 2" available water capacityE_a(6) = Actual evapotranspiration, 6" available water capacity

Source: U. S. Department of Commerce - U. S. Department of Agriculture, Normals of Evapotranspiration
(in inches) in Wyoming, undated.

SOILS

Supporting Data

Table 10

Aa-Ab - Arvada clay-clay loam

Arvada clay-clay loam occupies sloping terraces and alluvial fans that have been formed by local alluvium from upland soils. The soil has alkali or saline areas and bare spots where wind erosion has removed the surface and exposed the clay subsoil.

The surface horizon is light brownish gray friable clay or clay loam about 4 inches thick. The soil reaction (pH) ranges from slightly to strongly alkaline. The subsoil is brown to gray clay to clay loam about 20 inches thick and has columnar to prismatic structure. The substratum is clay loam to clay to 60 inches or more. The soil reaction of the subsoil and substratum ranges from strongly to very strongly alkaline. The internal drainage is very slow. The exchangeable sodium percentage of the subsoil and substratum is high, more than 15%.

Soil Classification: Ustollic Natrargid, fine, montmorillonitic, mesic

Estimated Physical & Chemical Properties									
Surface Texture	Surface Thickness Inches	AWC Inches	Permeability in/hr	Engineering Classification		Frost Hazard	Shrink-Swell	pH	Production Potential (#/AC dry wt.)
Clay loam	3-6	5-6	0.06	A-7	CL-CH	Low	High	7.4 to 9.0+	alkali-salinity CaCO ₃

Estimated Behavior Characteristics

	RATING	QUALIFICATIONS
Erosion Hazard (water)	High	basic erosion rate .65
Erosion Hazard (wind)	Moderate	fine textured, sodic and nearly level
Revegetation Potential	Low	saline, sodic, very slow permeability
Sprinkler Irrigation	Low	saline, sodic, very slow permeability
Final Cover for Mined Land (inches)	0	saline, sodic, slow permeability, clayey
Transportation Routes	Low	high shrink-swell, sodic, subject to piping
Roadfill Material	Low	high shrink-swell, sodic soils, subject to piping
Septic-Tank Absorption Fields	Low	very slow permeability - near streams
Sewage Lagoons	Low	near streams
Sanitary Landfills (trench)	Low	near streams, clayey textures
Small Commercial Buildings	Low	high shrink-swell
Hydrologic Group	D	sodic, clayey, slow permeability

Table 11

Ac - Arvada loam

Arvada loam occupies sloping terraces that have been formed by local alluvium. The soil has alkali or saline areas and bare spots where wind erosion has removed the surface and exposed the clay subsoil. The surface horizon is 5 - 10 inches thick and ranges from sandy loam to loam. The subsoil is clay loam to clay and has columnar to prismatic structure. The substratum is clay to silty clay loam to 60 inches or more. The soil reaction of the subsoil and substratum ranges from strongly to very strongly alkaline. The internal drainage is very slow. The exchangeable sodium percentage of the subsoil and substratum is high, more than 15%.

Soil Classification: Ustollic Natrargid, fine, montmorillonitic, mesic

Estimated Physical & Chemical Properties									
Surface Texture	Surface Thickness Inches	AWC Inches	Permeability in/hr	Engineering Classification		Frost Hazard	Shrink-Swell	pH	Production Potential (#/AC dry wt.)
Loam	3-6	5-6	0.06	A-7	CL-CH	Low	High	7.4 to 9.0+	alkali-salinity CaCO ₃

Estimated Behavior Characteristics

	RATING	QUALIFICATIONS
Erosion Hazard (water)	High	basic erosion rate .54
Erosion Hazard (wind)	Moderate	medium textured, sodic, nearly level
Revegetation Potential	Low	saline, sodic, slow permeability, clayey
Sprinkler Irrigation	Low	saline, sodic, slow permeability, clayey
Final Cover for Mined Land (inches)	0	saline, sodic, slow permeability, clayey
Transportation Routes	Low	high shrink-swell, sodic, subject to piping
Roadfill Material	Low	high shrink-swell, sodic, subject to piping
Septic-Tank Absorption Fields	Low	very slow permeability - near streams
Sewage Lagoons	Low	near streams
Sanitary Landfills (trench)	Low	near streams, clayey textures
Small Commercial Buildings	Low	high shrink-swell
Hydrologic Group	D	sodic, clayey, slow permeability

Table 12

Ba - Bankard fine sandy loam

Bankard fine sandy loam occupies nearly level floodplains that have been formed by local alluvium. The surface layer is grayish brown, mildly alkaline loamy sand about 3 inches thick. The subsoil is loamy fine sand texture, pale brown to light brownish gray and about 27 inches thick. The substratum is loamy sand to a depth of 60 inches or more. Internal drainage is very rapid. Soil reaction is moderately alkaline.

Soil Classification: Ustic Torrifluvent, sandy, mixed, calcareous, mesic

<u>Estimated Physical & Chemical Properties</u>									
Surface Texture	Surface Thickness Inches	AWC Inches	Permeability in/hr	Engineering Classification AASHO	Engineering Unified	Frost Hazard	Shrink-Swell	pH	Soluble Salts
Loamy sand	2-4	.05-.07	6-20	A-2	SM	Moderate	Low	7.9 to 8.4	CaCO ₃
<u>Production Potential (#/AC dry wt.)</u>									
1400-2500									

Estimated Behavior Characteristics

	<u>RATING</u>	<u>QUALIFICATIONS</u>
Erosion Hazard (water)	Moderate	basic erosion rate .17
Erosion Hazard (wind)	High	sandy
Revegetation Potential	Moderate	medium texture, deep
Sprinkler Irrigation	Low	intake rate too fast
Final Cover for Mined Land (inches)	0	too coarse, low water capacity
Transportation Routes	Moderate	occasional flooding
Roadfill Material	High	moderate frost action
Septic-Tank Absorption Fields	Moderate	occasional flooding
Sewage Lagoons	Very Low	rapid percolation
Sanitary Landfills (trench)	Very Low	percolation too rapid
Small Commercial Buildings	Low	flood hazard
Hydrologic Group	A	rapid permeability

Table 13

Bb - Satanta loam

Satanta loam occupies nearly level to undulating sloping uplands and high terraces. They formed in loamy, eolian materials that have been partially reworked by wind action. The surface horizon is dark grayish brown loam about 9 inches thick. The subsoil is grayish brown clay loam about 25 inches thick. Soil reaction is neutral to slightly alkaline.

Soil Classification: Aridic Argiustoll, fine-loamy, mixed, mesic

<u>Estimated Physical & Chemical Properties</u>									
Surface Texture	Surface Thickness Inches	AWC Inches	Permeability in/hr	Engineering Classification AASHO	Engineering Unified	Frost Hazard	Shrink-Swell	pH	Soluble Salts
Loam	8-10	<.5	0.6-2.0	A-4 to A-7	ML-CL	Low	Medium	6.1 to 8.4	-
<u>Production Potential (#/AC dry wt.)</u>									
1800-2500									

Estimated Behavior Characteristics

	<u>RATING</u>	<u>QUALIFICATIONS</u>
Erosion Hazard (water)	Medium	basic erosion rate .28
Erosion Hazard (wind)	High	coarse, loamy
Revegetation Potential	Moderate	low water holding capacity
Sprinkler Irrigation	Moderate	
Final Cover for Mined Land (inches)	9	good medium texture
Transportation Routes	Moderate	low strength, moderate shrink-swell
Roadfill Material	Moderate	moderate shrink-swell
Septic-Tank Absorption Fields	High	moderate permeability
Sewage Lagoons	Medium	too rapid permeability
Sanitary Landfills (trench)	Medium	slope
Small Commercial Buildings	Medium	moderate shrink-swell
Hydrologic Group	B	moderate permeability

Table 14

La - Haverson loam

Haverson loam occupies nearly level to very gently sloping floodplains that have been formed in alluvium. The surface horizon is light brownish gray loam, seven inches thick. The subsoil is light brownish gray loam stratified with thin lenses of sandy loam and very fine sandy loam to a depth of 60 inches.

Soil Classification: Ustic Torrifluent, fine-loamy, mixed (calcareous) mesic

<u>Estimated Physical & Chemical Properties</u>										
Surface Texture	Surface Thickness Inches	AWC Inches	Permeability in/hr	Engineering Classification AASHTO Unified		Frost Hazard	Shrink-Swell	pH	Soluble Salts	Production Potential (#/AC dry wt.)
Loam	6-10	.16-.18	0.6-2.0	A-4	ML	High	Moderate	7.9 to 8.4	CaCO ₃	1800
<u>Estimated Behavior Characteristics</u>										

Estimated Behavior Characteristics

	<u>RATING</u>	<u>QUALIFICATIONS</u>
Erosion Hazard (water)	High	
Erosion Hazard (wind)	Moderate	medium texture
Revegetation Potential	Moderate	moderate permeability
Sprinkler Irrigation	Moderate	medium texture
Final Cover for Mined Land (inches)	High	medium texture
Transportation Routes	Low	high susceptibility to frost heave
Roadfill Material	Low	high frost action
Septic-Tank Absorption Fields	Moderate	moderate permeability
Sewage Lagoons	Moderate	moderate permeability
Sanitary Landfills (trench)	Low	high frost action
Small Commercial Buildings	Low	high frost action
Hydrologic Group	B	moderate permeability

Table 15

Mb - McKenzie Clay

McKenzie clay occurs in shallow, intermittent lakes on upland landforms. The soil consists of gray or dark gray clay materials which have eroded from upland soils. McKenzie clay varies in stage of development as carbonate bearing layers may occur a few inches to several feet below the surface. The surface layer is 2 - 5 inches thick and ranges from sandy loam to clay. The substratum is dominantly a massive gray clay and may be more than 60 inches deep. Soil reaction is normally strongly to very strongly alkaline. Carbonate content is variable but usually increases with depth. Internal drainage is very slow. Saline and sodic salts are present in some locations.

Soil Classification: Typic Haplaquept, fine, montmorillonitic, mesic

Estimated Physical & Chemical Properties										
Surface Texture	Surface Thickness Inches	AWC Inches	Permeability in/hr	Engineering Classification		Frost Hazard	Shrink-Swell	pH	Soluble salts	Production Potential (#/AC dry wt.)
Clay	3-10	8-12	0.06	A-7	CL-CH	Moderate	High	7.0 to 8.5	Alkali-saline CaCO ₃	400-1000

Estimated Behavior Characteristics

	<u>RATING</u>	<u>QUALIFICATIONS</u>
Erosion Hazard (water)	High	basic erosion rate .65
Erosion Hazard (wind)	Moderate	fine textured, nearly level
Revegetation Potential	Low	clayey, saline, sodic, ponded water
Sprinkler Irrigation	Low	slow permeability, ponded water
Final Cover for Mined Land (inches)	Low	clayey, saline, possible sodic
Transportation Routes	Low	high shrink-swell, ponded water
Roadfill Material	Low	high shrink-swell, possible piping due to sodic soils
Septic-Tank Absorption Fields	Low	slow permeability, possible water table contamination
Sewage Lagoons	Low	possible water table contamination
Sanitary Landfills (trench)	Low	possible water table contamination
Hydrologic Group	D	clayey, slow permeability

Table 16

Rb - Renohill clay loam

Renohill clay loam occupies gently sloping to rolling uplands. The parent material is weathered shale of the Wasatch, Lance, and Fort Union formations. The clay loam surface horizon is 3 - 6 inches thick and has granular structure. The upper subsoil is clay to clay loam with prismatic and blocky structure. It normally contains no free calcium carbonate. The lower subsoil is clay loam and contains calcium carbonate. The clay loam substratum is calcareous extending to bedrock which occurs at depths of 20 - 40 inches. Soil reaction is normally neutral to moderately alkaline. The depth to calcareous material ranges from 6 - 20 inches. Internal drainage is slow.

Soil Classification: Ustollic Haplargid, fine, montmorillonitic, mesic

<u>Estimated Physical & Chemical Properties</u>									
Surface Texture	Surface Thickness Inches	AWC Inches	Permeability in/hr	Engineering Classification		Frost Hazard	Shrink-Swell	pH	Production Potential (#/AC dry wt.)
Clay loam	3-6	5-6	0.06-0.2	A-6	CL	High	High	7.0	CaCO ₃ 750-1800
				or				to	
				A-7				8.6	

Estimated Behavior Characteristics

	<u>RATING</u>	<u>QUALIFICATIONS</u>
Erosion Hazard (water)	High	basic erosion rate .54
Erosion Hazard (wind)	Moderate	clayey surface texture, smooth slopes
Revegetation Potential	Moderate	clayey, slow permeability
Sprinkler Irrigation	Low	clayey, slow permeability
Final Cover for Mined Land (inches)	6	fair, due to high clay content
Transportation Routes	Low	high shrink-swell
Roadfill Materials	Low	high shrink-swell, low strength
Septic-Tank Absorption Fields	Low	slow permeability and moderate depth
Sewage Lagoons	Low	bedrock at 20 - 40"
Sanitary Landfills (trench)	Low	bedrock at 20 - 40"
Small Commercial Buildings	Low	high shrink-swell
Hydrologic group	C	clayey, slow permeability

Table 17

Rc - Renohill clay loam, rolling phase

This rolling phase differs from Renohill clay loam in topography, depth of soil and degree of erosion. The topography is rolling to steep. The depth to bedrock ranges from less than 10 inches to 40 inches. Bedrock is exposed on some of the steeper slopes. Natural erosion has formed gullies in some areas. The parent material is weathered shale of the Lance, Wasatch, and Fort Union formations. The clay loam surface layer is generally 3 - 6 inches thick and has granular structure. The subsoil and substratum are clay loam to clay with carbonates at depth of 6 - 20 inches. Soil reaction is normally neutral to moderately alkaline. Internal drainage is slow.

Soil Classification: Ustollic Haplargid, fine montmorillonitic, mesic

<u>Estimated Physical & Chemical Properties</u>									
Surface Texture	Surface Thickness Inches	AWC Inches	Permeability in/hr	Engineering Classification		Frost Hazard	Shrink-Swell	pH	Production Potential (#/AC dry wt.)
Clay loam	3-6	5-6	.06-0.2	A-6	CL	High	High	7.0	CaCO ₃ 500-1400
				or				to	
				A-7				8.6	

Estimated Behavior Characteristics

	<u>RATING</u>	<u>QUALIFICATIONS</u>
Erosion Hazard (water)	High	basic erosion rate .47
Erosion Hazard (wind)	Low	clayey, rolling topography
Revegetation Potential	Moderate	clayey, slow permeability
Sprinkler Irrigation	Low	clayey, slow permeability
Final Cover for Mined Land (inches)	6	fair, due to high clay content
Transportation Routes	Low	high shrink-swell
Roadfill Material	Low	high shrink-swell
Septic-Tank Absorption Fields	Low	slow permeability, bedrock 20-40"
Sewage Lagoons	Low	bedrock at 20-40"
Sanitary Landfills (trench)	Low	bedrock at 20-40"
Small Commercial Buildings	Low	high shrink-swell
Hydrologic Group	C	clayey, slow permeability

Table 18

Rd - Renohill loam

Renohill loam occupies gently sloping to rolling uplands. The parent material is weathered shale of the Lance, Wasatch, and Fort Union formations. The loamy to sandy loam surface horizon is 3 - 8 inches thick. The upper subsoil is clay loam to clay with prismatic and blocky structure. It normally contains no free calcium carbonate. The lower subsoil is clay loam and contains calcium carbonate. The clay loam substratum is calcareous extending to bedrock which occurs at depths of 20 - 40 inches. Soil reaction is usually neutral to moderately alkaline. The depth to calcareous material ranges from 6 - 20 inches. Internal drainage is slow.

Soil Classification: Ustollic Haplargid, fine, montmorillonitic, mesic

			<u>Estimated Physical & Chemical Properties</u>							
Surface Texture	Surface Thickness Inches	AWC Inches	Permeability in/hr	Engineering Classification		Frost Hazard	Shrink-Swell	pH	Soluble Salts	Production Potential (#/AC dry wt.)
Loam	3-6	5-6	.06-	A-6	CL	High	High	7.0	CaCO ₃	750-2000
			0.2	A-7				8.6		

Estimated Behavior Characteristics

	<u>RATING</u>	<u>QUALIFICATIONS</u>
Erosion Hazard (water)	Moderate	basic erosion rate .47
Erosion Hazard (wind)	Moderate	medium textured, smooth slopes
Revegetation Potential	Moderate	medium texture, slow permeability subsoil
Sprinkler Irrigation	Moderate	medium texture, slow permeability subsoil
Final Cover for Mined Land (inches)	8	good, medium textures
Transportation Routes	Low	high shrink-swell, clayey
Roadfill Material	Low	high shrink-swell, clayey
Septic-Tank Absorption Fields	Low	slow permeability, bedrock 20-40"
Sewage Lagoons	Low	bedrock 20-40"
Sanitary Landfills (trench)	Low	bedrock 20-40"
Small Commercial Buildings	Low	high shrink-swell, clayey
Hydrologic Group	C	clayey, slow permeability

Table 19

Re - Renohill loam, rolling phase

This rolling phase differs from Renohill loam in topography, depth of soil and degree of erosion. The topography is rolling to steep. The depth to bedrock ranges from less than 10 inches to 40 inches. Bedrock is exposed on some of the steeper slopes. Natural erosion has formed gullies in some areas. The parent material is weathered shale of the Wasatch, Lance, and Fort Union formations. The loam to sandy loam surface layer is usually 3 - 6 inches thick. The upper subsoil is clay loam to clay with blocky and prismatic structure. It normally contains no free calcium carbonate. The lower subsoil is clay loam and contains calcium carbonate. The clay loam substratum is calcareous. Soil reaction is normally neutral to moderately alkaline. The depth to calcareous material ranges from 6 - 20 inches. Internal drainage is slow.

Soil Classification: Ustollic Haplargid, fine, montmorillonitic, mesic

<u>Estimated Physical & Chemical Properties</u>										
Surface Texture	Surface Thickness Inches	AWC Inches	Permeability in/hr	Engineering Classification		Frost Hazard	Shrink-Swell	pH	Soluble Salts	Production Potential (#/AC dry wt.)
Loam	3-6	5-6	.06-0.2	A-6	CL	High	High	7.0	CaCO ₃	600-1500
				A-7				8.6		

Estimated Behavior Characteristics

	<u>RATING</u>	<u>QUALIFICATIONS</u>
Erosion Hazard (water)	Moderate	basic erosion rate .47
Erosion Hazard (wind)	Moderate	medium texture, rolling topography
Revegetation Potential	Moderate	medium texture, slowly permeable subsoil
Sprinkler Irrigation	Moderate	medium texture, slowly permeable subsoil
Final Cover for Mined Land (inches)	8	good, medium textures
Transportation Routes	Low	high shrink-swell, clayey
Roadfill Material	Low	high shrink-swell, clayey
Septic-Tank Absorption Fields	Low	slow permeability, bedrock 20-40"
Sewage Lagoons	Low	bedrock 20-40"
Sanitary Landfills (trench)	Low	bedrock 20-40"
Small Commercial Buildings	Low	high shrink-swell, clayey
Hydrologic Group	C	clayey, slow permeability

Table 20

Rf - Rough Broken Land

Rough broken land consists of steep, eroded, strongly dissected areas along escarpments, steep-walled drainage channels and rock outcrops. The parent material is interbedded shale, sandstone, and limestone. Small areas of shallow to deep soils are intermingled in rough broken land. The density of vegetation is quite variable ranging from bare areas or sparse vegetation on rock outcrops to dense stands on the deeper soils. The physical and chemical properties of the unit are very variable.

Soil Classification: Unclassified and Ustic Torriorthents, loamy and clayey, montmorillonitic, calcareous, mesic, shallow

<u>Estimated Physical & Chemical Properties</u>										
Surface	Surface Thickness	AWC	Permeability	Engineering Classification		Frost	Shrink-Swell	pH	Soluble Salts	Production Potential
Texture	Inches	Inches	in/hr	AASHO	Unified	Hazard				(#/AC dry wt.)
Sandy loam to clay	2-6	0-3	.06-2.0	A-4 to A-7	SM-CL	Low to High	Low to High	7.0 to 8.4	CaCO ₃	200-1000
<u>Estimated Behavior Characteristics</u>										
			RATING	QUALIFICATIONS						
Erosion Hazard (water)			High	basic erosion rate .65						
Erosion Hazard (wind)			Low	roughness of topography						
Revegetation Potential			Low	shallow soils, low AWC						
Sprinkler Irrigation			Low	shallow soils, low AWC						
Final Cover for Mined Land (inches)			0	locally 6-10" fair (minor)						
Transportation Routes			Low	steep slopes, locally fair						
Roadfill Material			Moderate	locally fair due to rock content						
Septic-Tank Absorption Fields			Low	shallow to bedrock, steep slopes						
Sewage Lagoons			Low	shallow to bedrock, steep slopes						
Sanitary Landfills (trench)			Low	shallow to bedrock, steep slopes						
Small Commercial Buildings			Low	greater than 15% slopes						
Hydrologic Group			D	steep slopes, shallow soils						

Table 21

Rh - Rough Broken Land, Searing soil material

This unit is a complex of rough broken land and eroded areas of scoria. Rough broken land includes steep, eroded, strongly dissected areas along escarpments, steep-walled drainage channels and rock outcrops. Scoria is a red or reddish colored shaly material and clinker produced by the heating and partial fusing of clays during the burning of underlying coal beds. Searing soil is characterized by a reddish brown gravelly loam surface horizon about 5 inches thick. The subsoil is a gravelly clay loam to loam which has blocky structure. The substratum is a friable, calcareous gravelly loam. Bedrock generally occurs at an average depth of 2 feet. This unit has fragments and blocks of red shale, stone, and clinker scattered on the surface. Internal drainage is good.

Soil Classification: Unclassified and Ustic Torriorthent, loamy-skeletal over fragmental, mixed, non-acid, mesic

<u>Estimated Physical & Chemical Properties</u>										
Surface	Surface Thickness	AWC	Permeability	Engineering Classification		Frost	Shrink-Swell	pH	Soluble Salts	Production Potential
Texture	Inches	Inches	in/hr	AASHO	Unified	Hazard				(#/AC dry wt.)
Gravelly loam	2-4	2-3	.06-2.0	A-4 to A-7	SM-CL	Low	Low	7.0 to 8.4	CaCO ₃	200-1500
<u>Estimated Behavior Characteristics</u>										
			RATING	QUALIFICATIONS						
Erosion Hazard (water)			High	basic erosion rate .47						
Erosion Hazard (wind)			Low	roughness, dissected slopes						
Revegetation Potential			Low	gravelly shallow soils, steep slopes						
Sprinkler Irrigation			Low	gravelly shallow soils, steep slopes						
Final Cover for Mined Land (inches)			0	locally fair due to rock content						
Transportation Routes			Low	steep slopes, locally fair						
Roadfill Material			Moderate	locally fair due to rock content						
Septic-Tank Absorption Fields			Low	shallow to bedrock, steep slopes						
Sewage Lagoons			Low	shallow to bedrock, steep slopes						
Sanitary Landfills (trench)			Low	shallow to bedrock, steep slopes						
Small Commercial Buildings			Low	greater than 15% slopes						
Hydrologic Group			D	steep slopes, shallow soils						

Table 22

Sb - Searing gravelly loam

Searing gravelly loam is developing in scoria, the beds of burned shale and clinker that have been formed by the burning of underlying coal beds. The scoria beds consist of red hardened shales and red to nearly black clinkers. This soil occurs on undulating to rolling areas and includes scattered outcrops of scoria. The surface horizon is reddish brown gravelly loam about 5 inches thick. The subsoil is a reddish brown gravelly clay loam which has blocky structure. The substratum is friable, calcareous gravelly loam. Bedrock generally occurs at an average depth of 2 feet. Internal drainage is good.

Soil Classification: Ustollic Haplargid, fine-loamy, mixed mesic

<u>Estimated Physical & Chemical Properties</u>										
Surface Texture	Surface Thickness Inches	AWC Inches	Permeability in/hr	Engineering Classification AASHO	Engineering Unified	Frost Hazard	Shrink-Swell	pH	Soluble Salts	Production Potential (#/AC dry wt.)
Gravelly loam	2-5	2-4	0.2-0.6	A-4	ML-CL	Low	Low	7.0 to 8.5	CaCO ₃	500-1300

Estimated Behavior Characteristics

	<u>RATING</u>	<u>QUALIFICATIONS</u>
Erosion Hazard (water)	Moderate	basic erosion rate .32
Erosion Hazard (wind)	Low	rolling topography, medium textured
Revegetation Potential	Low	gravelly texture, bedrock at 20-40"
Sprinkler Irrigation	Moderate	bedrock at 20-40"
Final Cover for Mined Land (inches)	15	fair, scoria coarse fragments
Transportation Routes	Moderate	bedrock at 20-40"
Roadfill Material	Moderate	medium textures
Septic-Tank Absorption Fields	Low	bedrock at 20-40"
Sewage Lagoons	Low	bedrock at 20-40"
Sanitary Landfills (trench)	Low	bedrock at 20-40"
Small Commercial Buildings	Moderate	sloping soils
Hydrologic Group	C	bedrock at 20-40"

Table 23

Ta - Terry sandy loam

Terry sandy loam occupies sloping to moderately steep (6-15%) sidehill slopes formed from sandstone. The surface layer is grayish brown, fine sandy loam about 4 inches thick. Soil reaction is mildly alkaline. The subsoil is brown, fine sandy loam about eight inches thick. The subsoil reaction ranges from mildly to strongly alkaline. Internal drainage is moderately rapid.

Soil Classification: Ustollic Haplargid, coarse-loamy, mixed, mesic

<u>Estimated Physical & Chemical Properties</u>										
Surface Texture	Surface Thickness Inches	AWC Inches	Permeability in/hr	Engineering Classification AASHO	Engineering Unified	Frost Hazard	Shrink-Swell	pH	Soluble Salts	Production Potential (#/AC dry wt.)
Fine sandy loam	3-5	.10-.15	2.0-6.0	S-2 or A-4	SM-SC	Moderate	Low	6.8 to 8.6	CaCO ₃	1000-2000

Estimated Behavior Characteristics

	<u>RATING</u>	<u>QUALIFICATIONS</u>
Erosion Hazard (water)	High	steep slopes
Erosion Hazard (wind)	Moderate	medium texture
Revegetation Potential	Low	rapid permeability
Sprinkler Irrigation	Low	rapid permeability
Final Cover for Mined Land (inches)	5	medium textures
Transportation Routes	Moderate	slope, shallow to bedrock
Roadfill Material	Low	
Septic-Tank Absorption Fields	Low	bedrock less than 20"
Sewage Lagoons	Low	bedrock less than 20"
Sanitary Landfills (trench)	Low	bedrock less than 20"
Small Commercial Buildings	Moderate	slope, shallow to bedrock
Hydrologic Group	C	slow permeability

Table 24

Ub - Ulm clay loam, shallow phase

This phase differs from Ulm loam in topography, texture, and depth of soil. The topography is rolling and the depth to interbedded sedimentary bedrock ranges from 10 - 20 inches. The steeper slopes have some rock outcrops. The surface horizon is granular clay loam about 6 inches thick. The subsoil is calcareous silty clay loam with prismatic structure. The subsoil normally becomes more loamy and friable with depth. Internal drainage is moderate to slow. Soil reaction normally ranges from neutral to moderately alkaline.

Soil Classification: Ustollic Haplargid, fine-loamy, mixed mesic, shallow

<u>Estimated Physical & Chemical Properties</u>										
Surface Texture	Surface Thickness Inches	AWC Inches	Permeability in/hr	Engineering Classification		Frost Hazard	Shrink-Swell	pH	Soluble Salts	Production Potential (#/AC dry wt.)
Clay loam	3-6	2-4	0.2-0.6	A-6	ML-CL	Low	Mod-erate	7.0 to 8.6	CaCO ₃	500-1300

Estimated Behavior Characteristics

	<u>RATING</u>	<u>QUALIFICATIONS</u>
Erosion Hazard (water)	High	basic erosion rate .41
Erosion Hazard (wind)	Moderate	medium textured, rolling topography
Revegetation Potential	Low	bedrock less than 20"
Sprinkler Irrigation	Low	bedrock less than 20"
Final Cover for Mined Land (inches)	6	fair, clayey texture
Transportation Routes	Low	shaley bedrock less than 20"
Roadfill Material	Low	clayey texture
Septic-Tank Absorption Fields	Low	bedrock less than 20"
Sewage Lagoons	Low	bedrock less than 20"
Sanitary Landfills (trench)	Low	bedrock less than 20"
Small Commercial Buildings	Moderate	shrink-swell
Hydrologic Group	C	clayey, shallow

Table 25

Uc - Ulm loam

Ulm loam occupies gently sloping to rolling uplands. The parent material is interbedded sandstone, shale and loamstone. The surface horizon is friable loam 3 - 7 inches thick. The subsoil ranges from sandy clay loam to clay loam and has prismatic structure. The calcareous substratum ranges from sandy loam to clay loam and extends to weathered bedrock at depths of 20 - 40 inches. Soil reaction normally ranges from neutral to moderately alkaline. Internal drainage is good.

Soil Classification: Ustollic Haplargid, fine-loamy, mixed, mesic

<u>Estimated Physical & Chemical Properties</u>										
Surface Texture	Surface Thickness Inches	AWC Inches	Permeability in/hr	Engineering Classification		Frost Hazard	Shrink-Swell	pH	Soluble Salts	Production Potential (#/AC dry wt.)
Loam	3-6	4-7	0.2-0.6	A-4 to A-6	ML-CL	Low	Moder-ate	7.0 to 8.5	CaCO ₃	750-1800

Estimated Behavior Characteristics

	<u>RATING</u>	<u>QUALIFICATIONS</u>
Erosion Hazard (water)	Moderate	basic erosion rate .32
Erosion Hazard (wind)	Moderate	medium texture, rolling topography
Revegetation Potential	Moderate	bedrock at 20-40", medium texture
Sprinkler Irrigation	Moderate	bedrock at 20-40", medium texture
Final Cover for Mined Land (inches)	16	fair, includes clayey subsoil
Transportation Routes	Moderate	clayey textured subsoil
Roadfill Material	Moderate	clayey textured subsoil, bedrock at 20-40"
Septic-Tank Absorption Fields	Low	bedrock at 20-40"
Sewage Lagoons	Low	bedrock at 20-40"
Sanitary Landfills (trench)	Low	bedrock at 20-40"
Small Commercial Buildings	Moderate	shrink-swell
Hydrologic Group	C	bedrock at 20-40"

Table 26

Ud - Ulm loam, reddish subsoil phase

This phase occupies gently sloping to rolling uplands. It is developing in material weathering from brownish-red or light red sandy shale. The surface horizon is friable loam to sandy loam 6 inches thick. The reddish brown clay loam subsoil has blocky structure. The calcareous to neutral substratum ranges in texture from clay loam to sandy loam. The shaly parent material occurs at depths of 20 - 30 inches. Fragments of scoria are present on the surface and in the soil profile in most places. Soil reaction normally ranges from neutral to moderately alkaline. Internal drainage is good.

Soil Classification: Ustollic Haplargid, fine-loamy, mixed, mesic

Estimated Physical & Chemical Properties										
Surface Texture	Surface Thickness Inches	AWC Inches	Permeability in/hr	Engineering Classification AASHO	Unified	Frost Hazard	Shrink-Swell	pH	Soluble Salts	Production Potential (#/AC dry wt.)
Loam	3-6	4-7	0.2-0.6	A-4 to A-6	ML-CL	Low	Moderate	7.0 to 8.5	CaCO ₃	750-1800
Estimated Behavior Characteristics										
				RATING		QUALIFICATIONS				
Erosion Hazard (water)				Moderate		basic erosion rate .32				
Erosion Hazard (wind)				Moderate		medium texture, rolling topography				
Revegetation Potential				Moderate		bedrock at 20-40", medium texture				
Sprinkler Irrigation				Moderate		bedrock at 20-40", medium texture				
Final Cover for Mined Land (inches)				16		fair, includes clayey subsoil				
Transportation Routes				Moderate		clayey textured subsoil				
Roadfill Material				Moderate		clayey textured subsoil, bedrock at 20-40"				
Septic-Tank Absorption Fields				Low		bedrock at 20-40"				
Sewage Lagoons				Low		bedrock at 20-40"				
Sanitary Landfills (trench)				Low		bedrock at 20-40"				
Small Commercial Buildings				Moderate		shrink-swell				
Hydrologic Group				C		bedrock at 20-40"				

Table 27

Ue - Ulm loam, rolling phase

This phase differs from Ulm loam in topography, texture, and depth to bedrock. The topography is rolling to steep and often strongly dissected. The depth to bedrock is usually less than 20 inches. Bedrock is exposed on some of the steeper slopes. The parent material is interbedded sandstone, shale, and loamstone. Gullies have formed in some areas. The soil is more friable and sandy than Ulm loam. Soil reaction normally ranges from neutral to moderately alkaline. Internal drainage is good.

Soil Classification: Ustollic Haplargid, fine-loamy, mixed mesic

Estimated Physical & Chemical Properties										
Surface Texture	Surface Thickness Inches	AWC Inches	Permeability in/hr	Engineering Classification		Frost Hazard	Shrink-Swell	pH	Soluble Salts	Production Potential (#/AC dry wt.)
Loam	3-6	4-7	0.2-0.6	A-4 to A-6	ML-CL	Low	Moderate	7.0 to 8.5	CaCO ₃	500-1500
Estimated Behavior Characteristics										
				RATING		QUALIFICATIONS				
Erosion Hazard (water)				Moderate		basic erosion rate .32				
Erosion Hazard (wind)				Low		medium textures, rolling topography				
Revegetation Potential				Moderate		bedrock at 20-40", medium texture				
Sprinkler Irrigation				Moderate		bedrock at 20-40", medium texture				
Final Cover for Mined Land (inches)				10		good, medium texture				
Transportation Routes				Moderate		clayey textured subsoil				
Roadfill Material				Moderate		clayey textured subsoil				
Septic-Tank Absorption Fields				Low		bedrock at 20-40"				
Sewage Lagoons				Low		bedrock at 20-40"				
Sanitary Landfills (trench)				Low		bedrock at 20-40"				
Small Commercial Buildings				Moderate		shrink-swell				
Hydrologic Group				C		bedrock at 20-40"				

Table 28

Wa - Wibaux - Searing Complex

This complex occupies rolling to hilly topography. It is characterized by numerous outcroppings or knolls of scoria which rise above the general surface of the land. Scoria is a reddish colored shaly material and clinker produced by the burning of underlying coal beds. The very shallow to shallow Wibaux soils occur on the knolls and steep slopes. It includes knolls, mounds, and steep slopes where unweathered scoria is exposed. The texture is gravelly to very gravelly loam and sandy loam. The depth to bedrock is less than 10 inches to 20 inches.

Searing soil normally occurs between the knolls. The surface horizon is reddish brown gravelly loam about 5 inches thick. The subsoil is a reddish brown gravelly clay loam and has blocky structure. The substratum is friable, calcareous gravelly loam. Bedrock generally occurs at an average depth of 2 feet.

Soil Classification: Wibaux - Ustic Torriorthent, loamy-skeletal over fragmental, mixed, non-acid, mesic
Searing - Ustollic Haplargid, fine-loamy, mixed, mesic

<u>Estimated Physical & Chemical Properties</u>									
Surface Texture	Surface Thickness Inches	AWC Inches	Perme- ability in/hr	Engineering Classification AASHO Unified	Frost Hazard	Shrink- Swell	pH	Soluble Salts	Production Potential (#/AC dry wt.)
Gravelly loam	2-4	2-4	.06- 2.0	A-2 to A-4	SM-CL Low	Low	7.0 to 8.5	CaCO ₃	450-1200

Estimated Behavior Characteristics

	<u>RATING</u>	<u>QUALIFICATIONS</u>
Erosion Hazard (water)	High	basic erosion rate .32 to .41
Erosion Hazard (wind)	Low	roughness, rolling to hilly topography
Revegetation Potential	Low	gravelly, shallow to bedrock, steep
Sprinkler Irrigation	Low	gravelly, shallow to bedrock, steep
Final Cover for Mined Land (inches)	8	poor, gravelly
Transportation Routes	Moderate	steep slopes, locally good
Roadfill Material	High	locally poor due to texture
Septic-Tank Absorption Fields	Low	shallow to bedrock
Sewage Lagoons	Low	shallow to bedrock
Sanitary Landfills (trench)	Low	shallow to bedrock
Small Commercial Buildings	High	locally poor due to steep slopes
Hydrologic Group	D	shallow to bedrock

WILDLIFE AND FISH

Supporting Data

Wildlife and Fish

Impacts Analysis

It is often stated that some particular action will benefit "wildlife." Such a statement is usually inappropriate when it does not relate to a particular species. All species are different. What is beneficial to one species may be detrimental to another. Where some critical element of an animal's habitat is replaced by a substitute that does not fulfill the role of the critical element, the action cannot be considered habitat rehabilitation or habitat improvement as far as that species is concerned. Even though the substitute may be quite attractive under certain conditions, the loss of the critical habitat element usually makes the action detrimental to the species involved. As an example, one might establish palatable grasses and forbs on a railroad or road right-of-way through deer winter range where browse is the major factor limiting deer. Browse is destroyed during construction. Deer are attracted to the grass and forbs in the spring where they are subject to increased mortality through train or auto collisions. Because of their concentration in the area, they overuse the browse adjacent to the right-of-way. The concentration of deer on the seeded grasses and forbs may give the appearance of exceptional "habitat improvement" while in reality it results in increased mortality and long-term winter carrying capacity loss to the habitat.

The variety of animals in the basin is too great to permit detailed description of development and rehabilitation impacts on each species. In Table 11, Chapter V, species are grouped according to important habitat requirements, habits or life forms. Species in each group will be similarly affected by development action and rehabilitation. These

species groups will be used to illustrate differences in impacts resulting from differences in the animals themselves.

Direct destruction of animals

A number of development operations will directly destroy wild animals ranging from individuals to entire populations. Those actions which will cause the greatest losses are those which initially excavate, bury, overturn, clear or grade large areas of previously undisturbed terrestrial habitat. Examples are overburden removal, spoil piling, plant and facility site preparation, railroad and highway roadbed construction, pipeline excavation, homesite and service area preparation and canal and drainage diversion construction. The large machinery will bury, crush and suffocate many small animals, primarily those which are not capable of moving fast enough to escape and those which retreat to burrows for protection. A variety of invertebrates, mice, shrews, ground squirrels, prairie dogs, snakes, lizards, young birds, and eggs are potential casualties.

Any of the above operations, and others such as well drilling, blasting or industrial and municipal use of water, which cause dewatering of aquatic habitats will result in death to fishes, aquatic invertebrates, and amphibians in certain stages of life.

Permanent habitat losses

Considering the changes which have taken place in this country during the last 50 - 75 years and those probable in decades ahead, native wildlife habitat removed from the land for over 30 years must be considered permanently lost.

Actions which will result in permanent habitat losses include construction, operation and maintenance of railroads, highways, secondary roads, power plants and gasification plants and construction of office

buildings, equipment garages, coal loading and storage facilities and other mine site facilities. Additional habitat will be permanently lost with the expansion of population centers. Home building, commercial area expansion, new streets, parking lots, schools, sewage treatment plants, sanitary land fills, governmental facilities, airports, etc., will relegate thousands of acres of land to human use. All of the above actions will destroy wildlife habitat and preclude its reestablishment.

The greatest losses can be expected in the sagebrush and grass-land ecosystems since these predominate in the area, but aquatic habitat and terrestrial habitat in other ecosystems will also be lost. Almost all animal species in the basin will be affected. Total permanently lost acreage, based on the projections, will approximate 5,000 acres in 1980, 8,000 acres in 1985 and 10,000 acres in 1990. Total local populations of some animals will be immediately lost where habitats involved are limited and well defined. Where aquatic habitats are destroyed, animals such as those listed in Group VIII, Table 11 (Chapter V), will be impacted most severely. Local populations of invertebrates, most reptiles and amphibians, and small animals with limited ranges will be quickly lost when their required habitat is destroyed. The more mobile and wide-ranging animals such as birds, antelope, deer, elk, rabbits, and the predators will be displaced into adjacent areas. However, since population levels are determined by the availability of suitable habitat, displaced animals eventually succumb to natural mortality or they displace other resident animals. The end result will be a net loss to the overall populations of such species involved.

One area of potential permanent habitat loss not covered by projections involves the situation where the aquatic habitat of small streams and springs is dried up as a result of well drilling or mining operations.

The extent to which this may happen is unknown but it could cause significant additional losses of aquatic wildlife.

Permanent changes from terrestrial to aquatic categories may also occur. Water storage reservoirs and mine-pit lakes created where none previously existed can potentially convert hundreds of acres from terrestrial wildlife habitats to aquatic habitat. It is obvious that this could be quite beneficial to the animals of Group VIII, Table 11, while devastating to most of those in Groups II and III. These potentially permanent changes in habitat were not covered under "Disturbed Acres" in the projections either.

Initial habitat destruction followed by
some degree of recovery in habitat value

Mined lands, haul roads, railroad and road rights-of-way, pipeline and power line rights-of-way, borrow areas, cleared fence lines, temporary parking areas, initial spoil areas, temporarily diverted streams, and other areas will be stripped of almost all wildlife habitat value by the widescale excavation, overturning and clearing of the land surface. Where significant changes in topography, ground water conditions, surface drainage patterns or surface soil conditions occur, the potential to reestablish some previously existing habitat types may be permanently lost. After smoothing, shaping and replacement of a viable soil material on the surface of most of these disturbed areas, natural processes, often times influenced by man's reclamation activities, will begin to restore wildlife habitat in one form or another.

Plants are the immediate or ultimate source of all foods and most cover for wildlife. Various characteristics of the vegetative cover in an area determine to a large extent the kinds of wildlife which will be present. The initial stages of plant succession will begin on disturbed lands almost immediately after the disturbance ceases. At the time of disturbance, the

habitat value is almost totally lost for all wildlife. As succession proceeds, continual changes in the plant community influence the availability of food and cover plants and thus the kinds and numbers of animals present. The results of several studies of succession on abandoned farmlands in the sagebrush-grasslands of the study area indicate that revegetation of development disturbed lands to approximately original conditions can be expected to take over 50 years if left to natural succession (Lang 1941; Lang 1973; Ries, Fisser, and Harrison 1974). Lang's studies on abandoned farms showed that in the early stages of succession, the vegetation changed from a predominately annual weed type to a predominantly perennial grass type. Figure 6, Chapter V, shows the relative densities of the vegetative groups. Keep in mind that, after 9 years, the total vegetative cover was only slightly over 3 percent; cover was less than 50 percent of that found on adjacent undisturbed lands (Lang 1941). In the A.R.Co. coal lease area, data from recent studies of farmlands abandoned between 40 and 45 years ago indicate that total vegetative cover still averages about 43 percent less than average total cover on adjacent undisturbed rangeland. Average sagebrush cover has now recovered to about the same as that on undisturbed lands (Ries, Fisser, and Harrison 1974).

The long time period and the pattern seen in natural vegetative recovery in the basin is highly pertinent to artificial rehabilitation efforts on disturbed lands and their value as wildlife habitat. The forces of natural succession will still be very much at play on the disturbed lands in spite of man's rehabilitation efforts. In all probability, disturbed areas will be leveled or reshaped, some type of soil material may be spread over the area and grass species will be seeded and possibly fertilized. A fair grass stand

may be expected to establish initially over much of the area. Significant areas of poor or no grass establishment can be expected due to locally inhibiting conditions of soil, moisture, erosion, wild animal damage and, where unfenced, livestock damage. After almost five years, reseeded pipeline rights-of-way on the Atlantic coal lease had an average of over 60 percent less vegetative cover directly over the pipeline, where soil was deeply disturbed, than the average on adjacent rangelands. This vegetation was almost all planted grasses and weedy species. The average vegetative cover along the border of the pipeline averaged about 20 percent less than the average on adjacent native rangelands. Much of vegetative cover here was residual native plants indicating that the disturbance along the borders was slight. On reseeded oil well sites, there was at least 30 percent less vegetative cover than on the adjacent undisturbed rangeland and an average of over 80 percent of the vegetation present was unplanted weedy forbs. Planted grass made up about 10 percent of the vegetation. All of the studies reviewed and the observations of Bureau of Land Management and Forest Service personnel familiar with the area indicate that the shrub group, predominantly sagebrush, is lost or severely reduced on all sites disturbed to any appreciable degree of severity. This condition appears to persist for a minimum of 20 to 30 years with or without artificial rehabilitation efforts. (See Figure 7, Chapter V.)

After initial attempts to rehabilitate disturbed areas to perennial grasslands, the majority of the lands will eventually be subject to the same general conditions of climate, grazing and land use as other rangelands in the region. Reestablished vegetation which has been subject to special practices such as temporary irrigation, fertilization, total protection from grazing, etc., may not be able to survive. Where the artificial revegetation fails, natural plant succession will take over the long, slow process. Once these sagebrush grasslands have been severely disturbed,

they may be unable to recover to a point to which they will provide habitat of similar type, quality, quantity and for the array of species that presently exists on the undisturbed rangeland. In 1965, 20 plus years after his early research, Lang found that the vegetation on his original abandoned farmland and study area actually deteriorated further, rather than improving. Total ground cover decreased by 40 percent (Lang 1973, p. 408). This happened under conditions of grazing and climate which cannot be considered uncommon for this region.

After analysis of the available data, it seems reasonable to make several general observations concerning the nature of the vegetative cover which will be established on disturbed lands in the study area between now and 1995. They are:

- The total vegetative cover will be greatly reduced, probably near 50 percent of that found on adjacent undisturbed range.
- The shrub component will be absent or nearly so.
- There is a good possibility that reestablished plant communities will deteriorate rather than improve over time as they are exposed to periodic drought, continued grazing, etc.
- The composition trends of plant species groups will approximate those shown in Lang's graph (Figure 6, Chapter V). Exceptions will be, that where perennial grass establishment due to rehabilitation is fairly successful, the trend line will rise sharply in the first few years rather than later as shown, and that the weed or forb trend line will drop earlier.

Because of various important plant-animal interrelationships, the recovery of habitat value for many species will approximate the recovery of that portion of the plant community with which they have close ties. Figure 7, Chapter V, presents a qualitative indication of trends in habitat value for several of the animal groups listed in Table 11, Chapter V. The species groupings, while flexible, are logical for

the study area. They are based upon similarity of habitat requirements, habits or life form. The habitat value trends are based on a comparison of existing habitat types with those expected to develop as a result of rearranged topography, artificial vegetative rehabilitation efforts and the natural forces of plant succession, and erosion on disturbed areas.

The broad type called sagebrush-grassland usually includes a variety of different shrub and grass communities and gradations between them (Figure 13). Under natural conditions some animals more heavily depend upon, or thrive in association with, the shrub component, some with the perennial grassland component, and others with weedy annuals, forbs, etc., common on disturbed areas. For those animals closely associated with the sagebrush and shrub component of the sagebrush grassland, Group I in Table 11, habitat values are expected to remain severely reduced on disturbed lands throughout the study period. The animals of Group II, primarily heavy users of weed seed, forbs, and weedy species, will probably experience increases in habitat value a short time after the initial habitat loss. This group will probably be the only group to experience "habitat improvement" over present conditions, during the study period. Habitat value for Group III animals is expected to recover significantly within five to ten years after disturbance, depending heavily on the success of the expected efforts to reestablish perennial grasslands.

Many animals of the study area are primarily dependent upon various vegetative aspects of the more moist riparian community (see Figure 14). Where this community is destroyed by development, the grass-forb component is not expected to recover significantly for 5 to 10 years. If favorable hydrologic characteristics are not permanently destroyed,

habitat values of the shrub component may show significant recovery in 10 to 15 years. Almost no recovery of habitat values associated with cottonwood trees above the sapling stage is expected during the study period. In general, the habitat values for animals of Group IV will remain severely reduced far beyond the study period.

The total disturbed acreage of pine timber, juniper breaks and rough rocky areas which fulfill the habitat requirements of the animals of Group V is expected to be small. In those situations where they are destroyed, habitat values for the species involved will be lost, probably for many years beyond the study period.

Insects and other invertebrates, Group VI, occupy a multitude of microhabitats throughout all biotic communities. Insects tend to reach their greatest abundance and species diversity in the intermediate stages of succession in grassland types (Kendeigh 1961, p. 115). It is probable that the majority of the sagebrush-grassland type in the study area is in intermediate stages of succession since most of this land has long been heavily grazed. Insect habitat value is probably near its greatest potential now, except in severely overgrazed areas. If grassland rehabilitation efforts are successful, intermediate stages of grassland development may be bypassed. In this situation abundance and species diversity would be reduced, but habitat for particular insect groups may recover rapidly. Total numbers and biomass of sagebrush-grassland invertebrates could be expected to remain reduced until such time as the reestablished plant community either progressed or digressed to one similar to the original community both in relative vegetative group density and total vegetative cover. It is estimated that this could take anywhere from 15 to over 50 years. Invertebrate habitat values, lost with the destruction of aquatic, riparian and other habitat types, will remain lost or reduced similar to the habitat values of the other animals found there.

The insectivores of Group VII and the predators of Group IX are secondary consumers dependent upon the plant communities for a food source through other animals. A particular species of either group may also depend heavily on the plant community for a particular type of cover, nesting site, etc. The quality of habitat for a particular species within either group is strongly influenced by the availability of its prey species. Recovery of destroyed habitat for the animals with flexible food habits or whose prey species are favored early in rehabilitation i.e., Group II, will probably be complete within a few years after disturbance. This may well be the case for red fox and coyote. Habitat for more specialized species such as the short horned lizard may not recover to pre-disturbance condition for 15 to 20 years. A severe reduction with negligible recovery of cottontail rabbit habitat due to loss and negligible recovery of the shrub component in sagebrush-grassland will also mean a reduction and negligible recovery of the winter food supply for golden eagles over the study area. With the types of habitat which will be disturbed and the vegetative recovery expected, the capability to support the present total numbers of biomass of predators and insectivores will be lost on the disturbed lands and will remain reduced well beyond the study period.

Aquatic and semi-aquatic animals are inseparably tied to the stream, lake and pond-marsh biotic communities. Where the water source is not lost during disturbance, there is potential for restoring aquatic communities. Where disturbance is slight, recovery will be rapid. Where streams are channeled and moved back and forth across the land as coal mining proceeds, aquatic communities cannot be expected to recover to any great extent. Aquatic habitat is limited in extent within the study area.

There appears to be a potential for significant additions with development of mine-pit lakes after mining. It is not known to what extent this is feasible. With proper construction to include aquatic habitat enhancement, these lakes could result in a gain in aquatic habitat over the present conditions in the basin. Here again, some species may gain while others loose, for example, where stream habitat is lost and lake habitat is gained. Aquatic habitat values over the study area are expected to remain reduced throughout most of the study period, but they may recover significantly in 15 to 20 years if mining companies see fit to construct mine-pit lakes.

Habitat impaired or reduced in value

In addition to those physical losses of habitat which are specific to a particular acreage of disturbance or development, wildlife will suffer further significant losses due to off-site reduction in habitat quality.

The almost three-fold increase in population expected by 1990 will foster tremendous increases in human activity over the immediate study area. Humans will be living, working and recreating in wildlife habitat never before impacted by this level of intrusion. In addition to the noise, activity, smell and pollution around the whole gamut of new developments and expansions, wildlife will be intruded upon by greatly increased numbers of workmen, planners, investigators, recreationists, etc., operating various utility and recreation vehicles and airplanes over the back country areas. Human intrusion is tolerated only to a certain point by most wild animals. The degree of tolerance varies widely between species. As long as their habitat is intact, insects, for example, are relatively indifferent to human activity. Conversely, habitat of most of the larger mammals and predators will be abandoned close to areas of intense human activity. Habitat

may be used only occasionally in areas near heavy intermittent human concentration or use may be only lightly reduced with low intensity human activity. Variable zones of extended human influence around developments affect, particularly, the living space component as well as the cover, food and water components of wildlife habitat. Some of the more obvious factors establishing these zones, which are often observed in Wyoming, are wide-ranging domestic cats and dogs, concentrations of shooting, hunting and trapping youngsters, motorcycles, dune buggy and 4-wheel drive race and "test" courses, weed control efforts, increased incidences of man-caused fires and accidental land and water pollution and the concentrated effects of converging transportation and utility routes. Another common phenomenon impacting wildlife, usually on the outskirts of towns and along stream courses, is the expansion of semi-rural "acreage" areas where large areas of land are occupied in 1 to 15 or 20 acre plots. These areas are often heavily cross-fenced and heavily overgrazed by family horses and other "pet" livestock. Around industrial sites and along transportation corridors, vegetation is often reduced in palatability by dust and smoke pollutants. Tight fencing and intense weed control is often practiced along railroads, highways and around industrial sites.

As an example of the extent of concentrated human activity which is projected for the study area in 1990, one might picture the approximately 48 square miles and 45,000 population of the urban area encompassing Casper, Wyoming, split onto about 20 sites in a 100 mile, north-south swath through the center of the study area. In terms of population, acreage of surface disturbance or permanent use, and on-site human activity, it is a fair approximation. If each of the twenty sites were of similar size the average

would be about 2.5 square miles. Considering, for example, a 1/2 mile wide strip around each site as an area of lost or severely reduced habitat value for big game animals, the additional impact area would be almost twice the size of the development area. The total area of habitat lost or reduced in each "spot" would cover almost seven square miles. Of course, the width of such an impact zone would vary with the species involved, type of activity taking place in the developed area, its physical shape and layout and the quality of escape cover, etc. An "influence" strip one mile wide around each spot would increase the habitat area influenced by almost five times.

Most of the habitat deteriorating effects of the more dispersed human activities which will increase in the study area are more difficult to define. The affects of harrassment and disturbance will disrupt the living space component of habitat. The more severe affects will be felt during stress periods and in crucial areas for various species. Where game bird and waterfowl nesting areas are subject to human activity, nesting success will be reduced. Where wintering big game are harrassed, losses of weakened animals and abortions may occur. Where boating, camping and other recreation activities take place in increased concentrations, as may be expected around Keyhole Reservoir and other recreational waters, aquatic and surrounding terrestrial habitat will be degraded from pollution and disturbance.

Development activites such as coal mining or well drilling may cause losses of surface waters critical to many species over significant areas in arid areas.

It appears certain that the combined affects of impaired wildlife habitats will result in reduced wildlife production on an additional acreage three to five times larger than the projected 30,000+ acres to be lost or reduced through actual habitat destruction by 1990. Nearly all species will suffer but those species of greatest interest to man will probably suffer most.

It is apparent that these actions described above will cause major cumulative negative impacts on wildlife habitats throughout the study area. Significantly, the magnitudes mentioned above do not take into consideration coal development after 1990, much of the development of private and state land coal, or developments already expanding in the basin related to production of uranium, oil and gas, and others.

Disruption of existing ecological interrelationships

Development of the basin will cause numerous secondary effects on wildlife through the disruption of food chains, behavior patterns, and various activities of species playing key roles in the ecosystem. These interactions are often subtle and complex but their disruption can cause significant negative impacts on certain species. Some of the more important examples follows.

Big game animals displaced into other areas of suitable habitat almost invariably encounter resident animals of the same species occupying the habitat at or near its carrying capacity. While natural mortality factors will eventually eliminate the excess animals if man doesn't, it is well documented that before this is accomplished the animals, especially browsers, often severely overuse the browse range. This can result in a

further overall reduction in carrying capacity and animal numbers in the region that will be evident for many years.

If the type of vegetation which establishes on significant acreages of disturbed land encourages high rodent populations, predators such as coyotes and fox will tend to increase in the general area. As vegetative composition progresses toward that of perennial grassland, rodent populations may sharply decline. The predators will then increase use of alternate prey species, often those of particular interest to man, such as sheep or game birds. Further, humans may react to this situation by demanding increased predator control which has further ramifications.

The burrow systems of prairie dog colonies are important to a number of species in the sagebrush grasslands. Loss of these colonies through mining or other development activities will reduce the available habitat for, among other species, the "endangered" black footed ferret and the western burrowing owl considered "status undetermined" by the U.S. Department of Interior. Overshooting of prairie dog colonies by varmint hunters will make these colonies unacceptable as ferret habitat.

Improved habitat

The broad-scale development forthcoming in the basin, both from coal related development and other industrial development, will bring about significant changes in the wild fauna. Most changes will be toward less total wildlife production and will involve trade-offs between species and types of wildlife or between wildlife in one area for wildlife in another. There is some potential for improved habitat and benefited wildlife if we keep in mind that this usually does mean trade-offs.

There is optimism that the potential exists for the creation of several hundreds of acres of fish and waterfowl habitat in mine-pit lakes.

Available water supply to fill and maintain water quality in these lakes may be a limiting factor. Large quantities of out-basin water may be imported for industrial use. Clean waste water from these sources may provide an additional water supply in some situations. Careful planning and construction of these lakes will be required if significant wildlife habitat values are to be realized.

The disturbance of large land areas is expected to result in vegetative changes favoring increases in population of some rodent species. Certain predators will benefit from these increases in prey species. These improved habitat conditions are expected to be temporary in any particular area of disturbed land.

In some areas of rough, steep terrain, where overburden becomes deep, areas of high-wall cliffs may be left exposed. These areas could provide increased nesting sites for birds such as the rare prairie falcon, eagles, various other raptors, and swallows.

Increased human populations will bring increases in the population of exotic wildlife which commonly thrive around human settlements. Some of these include the English sparrow, house mouse, Norway rat, and the starling.

Habitat changes resulting from off-site changes in land and water use

Impacts upon terrestrial and aquatic habitat falling outside of the study area must also be anticipated. Industrial water requirements in the Powder River Basin are certain to increase beyond that which is available "on-site." Several proposals and alternatives have been suggested to allow "importations" of additional water for use during coal development.

Drilling of deep wells in the study area would remove water from an aquifer which underlies lands outside of the study area as well. Off-site springs, seeps or wetlands, presently valuable to upland or aquatic fish and wildlife species may be reduced or eliminated through eventual lowering of the water table.

Trans-basin diversion (taking water from one drainage and placing it in another) might involve the construction of storage impoundments, on the Green River, for example, as well as change existing water uses. Flooding or drying of existing terrestrial and aquatic habitat will become a land affecting possibility. Adverse impacts on associated fauna can be expected. Several off-site storage reservoirs have already been proposed (Wheatland, Green River, Bighorn Slope, Nowood and increased storage in Lake DeSmet).

At the present time, most water consumed in northeastern Wyoming is used for irrigation and agriculture. Changes in existing agricultural water uses would affect fish and wildlife use patterns. A shortage of irrigation water may result in croplands reverting to native vegetation. Existing pheasant habitat, for example, may be lost. Many species of wildlife presently depend on irrigated lands for all or part of their habitat requirements.

Impacts on wildlife management

Projected population increases between 1970 and 1990 are estimated at over 200 percent of the present population in the study area and a 60 percent increase throughout northeast Wyoming. This will be accompanied by comparable increases in consumptive and non-consumptive pressures on wildlife resources. Most game species of fish, birds and mammals will not be able to absorb

increased pressures. Where population of some species are adequate to absorb increased pressure in general, problems of new access, denied access, closed lands and restricted areas will cause problems of over-exploitation in some areas, under-exploitation in others, more wildlife damage claims, etc.

The Wyoming Game and Fish Department presently employs Game Wardens, Big Game Biologists, Bird Biologists, Fisheries Biologists, Waterfowl Biologists and others amounting to 15 to 25 employees for enforcement and management in the study area. The present staff of employees, in each category, will be unable to adequately meet the increased enforcement, management and habitat development needs or the increased needs for studies, research, or coordination and cooperation with industry and government in the face of the proposed development.



Figure 13

Antelope in Sagebrush-Grassland Habitat



Figure 14

Well-Developed Riparian Habitat in the Study Area

Table 29

Taxonomic Ranking, Scientific and Common Names for Mammals
Which May Be Found on or Near the Study Area

Species	Taxonomic Rank
	Order Marsupialia - Marsupials
	Family Didelphidae - Opossums
<u>Didelphis marsupialis virginiana</u> Kerr (opossum)	
	Order Insectivora - Insectivores
	Family Soricidae - Shrews
<u>Sorex cinereus cinereus</u> Kerr	
<u>Sorex cinereus haydeni</u> Baird (masked shrew)	
<u>Sorex merriami leucogenys</u> Osgood (Merriam's shrew)	
<u>Sorex vagrans obscurus</u> (vagrant shrew)	
	Order Chiroptera - Bats
	Family Vespertilionidae - Vespertilionid bats
<u>Euderma maculata</u> (spotted bat)	
<u>Myotis lucifugus carissima</u> Thomas (little brown myotis)	
<u>Myotis subulatus subulatus</u> (Say) (small-footed myotis)	
<u>Myotis volans interior</u> Miller (long-legged myotis)	
<u>Lasionycteris noctivagans</u> (Le Conte) (silver-haired bat)	
<u>Myotis keenii septentrionalis</u> (Trouessart) (Keen's myotis)	
<u>Myotis evotis evotis</u> (H. Allen) (long-eared myotis)	
<u>Lasiurus cinereus cinereus</u> (Palisot de Beauvois) (hoary bat)	
<u>Plecotus townsendii pallescens</u> (Miller) (Townsend's bat)	
<u>Eptesicus fuscus pallidus</u> Young (big brown bat)	
	Order Lagomorpha
	Family Leporidae - Rabbits and Hares
<u>Sylvilagus nuttallii grangeri</u> (J. A. Allen) (Nuttall's cottontail)	
<u>Sylvilagus audubonii bailevi</u> (Merriam) (desert cottontail)	
<u>Lepus townsendii campanius</u> Hollister (white-tailed jackrabbit)	
<u>Lepus californicus melanotis</u> Mearns (black-tailed jackrabbit)	
	Order Rodentia
	Family Sciuridae - Squirrels
<u>Eutamias minimus operarius</u> (least chipmunk)	
<u>Eutamias minimus pallidus</u> (J. A. Allen) (least chipmunk)	
<u>Spermophilus tridecemlineatus olivaceus</u> (thirteen-lined ground squirrel)	
<u>Spermophilus tridecemlineatus pallidus</u> J. A. Allen (thirteen-lined ground squirrel)	
<u>Cynomys ludovicianus ludovicianus</u> (Ord) (black-tailed prairie dog)	

Table 29 Continued

Species	Taxonomic Rank
Family Geomyidae - Pocket gophers	
<u>Thomomys talpoides attenuatus</u> Hall & Montague	
<u>Thomomys talpoides bullatus</u> V. Bailey	
(northern pocket gopher)	
<u>Thomomys talpoides cheyennensis</u>	
(northern pocket gopher)	
<u>Thomomys talpoides nebulosus</u>	
(northern pocket gopher)	
<u>Geomys bursarius lutescens</u> Merriam	
(plains pocket gopher)	
Family Heteromyidae - Pocket mice and Kangaroo rats	
<u>Perognathus fasciatus olivaceogriseus</u> Swenk	
(olive-backed pocket mouse)	
<u>Perognathus flavus piperi</u> Goldman	
(silky pocket mouse)	
<u>Perognathus hispidus paradoxus</u> Merriam	
(hispid pocket mouse)	
<u>Perognathus fasciatus callistus</u>	
(pocket mouse)	
<u>Dipodomys ordii priscus</u> Hoffmeister	
<u>Dipodomys ordii terrosus</u> Hoffmeister	
(Ord's kangaroo rat)	
<u>Dipodomys ordii luteolus</u>	
(Ord's kangaroo rat)	
Family Castoridae - Beavers	
<u>Castor canadensis missouriensis</u> Bailey	
(beaver)	
Family Cricetidae - Cricetids	
<u>Reithrodontomys montanus albescens</u> Cary	
(plains harvest mouse)	
<u>Reithrodontomys megalotis dychei</u> J. A. Allen	
(western harvest mouse)	
<u>Reithrodontomys megalotis dychei</u>	
<u>Peromyscus maniculatus nebrascensis</u> (Coues)	
(deer mouse)	
<u>Peromyscus leucopus aridulus</u> Osgood	
<u>Onychomys leucogaster arcticeps</u> Rhodes	
<u>Onychomys leucogaster missouriensis</u> (Audubon and Bachman)	
(northern grasshopper mouse)	
<u>Neotoma cineria orolestes</u> Merriam	
(bushy-tailed wood rat)	
<u>Neotoma cineria rupicola</u>	
(bushy-tailed wood rat)	
<u>Microtus pennsylvanicus insperatus</u> (J. A. Allen)	
(meadow vole)	
<u>Microtus longicaudus longicaudus</u> (Merriam)	
(long-tailed vole)	
<u>Microtus ochrogaster haydenii</u> (Baird)	
(prairie vole)	
<u>Lagurus curtatus levidensis</u> (Goldman)	
(sagebrush vole)	
<u>Ondatra zibethicus cinnamominus</u> (Hollister)	
(muskrat)	
Family Muridae - Murids	
<u>Mus musculus domesticus</u> Ratty	
(house mouse)	
Family Erethizontidae - Porcupines	
<u>Erethizon dorsatum bruneri</u> Swenk	
(porcupine)	
Order Carnivora - Carnivores	
Family Canidae - Canids	
<u>Canis latrans latrans</u> Say	
(coyote)	
<u>Vulpes vulpes regalis</u> Merriam	
(red fox)	
<u>Vulpes velox velox</u> (Say)	
(swift fox)	
<u>Urocyon cinereoargenteus ocuvthous</u> Bangs	
(gray fox)	

Table 29 Continued

Species	Taxonomic Rank
<u>Procyon lotor hirtus</u> Nelson & Goldman (raccoon)	Family Procyonidae - Procyonids
<u>Mustela erminea muricus</u> (Bangs) (ermine)	Family Mustelidae - Mustelids
<u>Mustela frenata nevadensis</u> Hall (long-tailed weasel)	
<u>Mustela frenata longicauda</u> (long-tailed weasel)	
<u>Mustela vison letifera</u> Hollister (mink)	
<u>Taxidea taxus taxus</u> Schreber) (badger)	
<u>Mustela nigripes</u> (Audubon & Bachman) (black-footed ferret)	
<u>Spilogale putorius interrupta</u> (Rafinesque) (spotted skunk)	
<u>Mephitis mephitis hudsonica</u> Richardson (striped skunk)	
<u>Lynx rufus pallescens</u> Merriam (bobcat)	Family Felidae - Cats
<u>Cervus canadensis nelsoni</u> V. Bailey (American elk)	Order Artiodactyla - Artiodactyls
<u>Odocoileus hemionus hemionus</u> (Rafinesque) (mule deer)	Family Cervidae - Deer
<u>Odocoileus virginianus dacotensis</u> (Goldman and Kellogg) (white-tailed deer)	
<u>Antilocapra americana americana</u> (Ord) (pronghorn)	Family Antilocapridae - Pronghorn

Table 30

Scientific and Common Names of Reptiles and Amphibians
Which May Be Found on or Near the Study Area

Species		
<u>Family</u>	<u>Common Name</u>	<u>Scientific Name</u>
Ambystomidae	Tiger salamander	<u>Ambystoma tigrinum</u>
Pelobatidae	Plains spadefoot toad	<u>Scaphiopus bombifrons</u>
Bufonidae	Great plains toad	<u>Bufo cognatus</u>
	Woodhouse's toad	<u>Bufo woodhousei</u>
Hylidae	Chorus frog	<u>Pseudacris triseriata</u>
Ranidae	Leopard frog	<u>Rana pipiens</u>
Chelydridae	Snapping turtle	<u>Chelydra serpentina</u>
Testudinidae	Painted turtle	<u>Chrysemys picta</u>
Trionychidae	Spiny softshell turtle	<u>Trionyx spiniferus</u>
Iguanidae	Sagebrush lizard	<u>Sceloporus graciosus</u>
	Short-horned lizard	<u>Phrynosoma douglassi</u>
Colubridae	Western hognose snake	<u>Heterodon nasicus</u>
	Smooth green snake	<u>Opheodrys vernalis</u>
	Racer snake	<u>Coluber constrictor</u>
	Gopher snake	<u>Pituophis melanoleucus</u>
	Milk snake	<u>Lampropeltis triangulum</u>
	Common garter snake	<u>Thamnophis sirtalis</u>
	Western terrestrial garter snake	<u>Thamnophis elegans</u>
	Plains garter snake	<u>Thamnophis radix</u>
Viperidae	Western rattlesnake	<u>Crotalus viridis</u>

Table 31

Scientific and Common Names of Birds Which May
Be Found on or Near the Study Area

Order/Family	Common Name	Scientific Name
PODICIPEDIFORMES (Grebes)	Eared grebe	<u>Podiceps caspicus</u>
	Western grebe	<u>Aechmophorus occidentalis</u>
	Pied-billed grebe	<u>Podilymbus podiceps</u>
CICONIIFORMES (Hérons, Ibises, Bitterns)	Great blue heron	<u>Ardea herodias</u>
	Black-crowned night heron	<u>Nycticorax nycticorax</u>
	White-faced ibis	<u>Plegadis chihi</u>
	American bittern	<u>Botaurus lentiginosus</u>
ANSERIFORMES (Waterfowl)	Canada goose	<u>Branta canadensis</u>
	Snow goose	<u>Chen caerulescens</u>
	Mallard	<u>Anas platyrhynchos</u>
	Gadwall	<u>Anas strepera</u>
	Pintail	<u>Anas acuta</u>
	Green-winged teal	<u>Anas crecca</u>
	Blue-winged teal	<u>Anas discors</u>
	Cinnamon teal	<u>Anas cyanoptera</u>
	American widgeon	<u>Anas americana</u>
	Northern shoveler	<u>Anas clypeata</u>
	Redhead	<u>Aythya americana</u>
	Ring-necked duck	<u>Aythya collaris</u>
	Canvasback	<u>Aythya valisineria</u>
	Lesser scaup	<u>Aythya affinis</u>
	Common goldeneye	<u>Bucephala clangula</u>
	Ruddy duck	<u>Oxyura jamaicensis</u>
	Common merganser	<u>Mergus merganser</u>
FALCONIFORMES (Vultures, Hawks, Falcons)	Turkey vulture	<u>Cathartes aura</u>
	Sharp-shinned hawk	<u>Accipiter striatus</u>
	Cooper's hawk	<u>Accipiter cooperii</u>
	Red-tailed hawk	<u>Buteo jamaicensis</u>
	Swainson's hawk	<u>Buteo swainsoni</u>
	Rough-legged hawk	<u>Buteo lagopus</u>
	Ferruginous hawk	<u>Buteo regalis</u>
	Golden eagle	<u>Aquila chrysaetos</u>
	Bald eagle	<u>Haliaeetus leucocephalus</u>
	Marsh hawk	<u>Circus cyaneus</u>
	Gyr falcon	<u>Falco rusticolus</u>
	Prairie falcon	<u>Falco mexicanus</u>
	Peregrine falcon	<u>Falco peregrinus</u>
	Merlin	<u>Falco columbarius</u>
	American kestrel	<u>Falco sparverius</u>
GALLIFORMES (gallinaceous birds)	Sage grouse	<u>Centrocercus urophasianus</u>
	Sharp-tailed grouse	<u>Pedioecetes phasianellus</u>
	Chukar partridge	<u>Alectoris chukar</u>
	Gray partridge	<u>Perdix perdix</u>
	Ring-neck pheasant	<u>Phasianus colchicus</u>
GRUIFORMES (Cranes and their allies)	Sandhill crane	<u>Grus canadensis</u>
	Sora	<u>Porzana carolina</u>
	American coot	<u>Fulica americana</u>
	Virginia rail	<u>Rallus limicola</u>
CHARADRIIFORMES (Shorebirds, gulls, etc.)	Killdeer	<u>Charadrius vociferus</u>
	Mountain plover	<u>Charadrius montana</u>
	Long-billed curlew	<u>Numenius americanus</u>
	Whimbrel	<u>Numenius phaeopus</u>
	Upland plover	<u>Bartramia longicauda</u>
	Spotted sandpiper	<u>Actitis macularia</u>
	Solitary sandpiper	<u>Tringa solitaria</u>
	Willet	<u>Catoptrophorus semipalmatus</u>
	Greater yellow legs	<u>Tringa melanoleucus</u>
	Lesser yellow legs	<u>Tringa flavipes</u>
	Pectoral sandpiper	<u>Calidris melanotos</u>

Table 31 Continued

Order/Family	Common Name	Scientific Name
CHARADRIIFORMES (Continued)		
	Baird's sandpiper	<u>Calidris bairdii</u>
	Least sandpiper	<u>Calidris minutilla</u>
	Long-billed dowitcher	<u>Limnodramus scolopaceus</u>
	Semipalmated sandpiper	<u>Calidris pusillus</u>
	Western sandpiper	<u>Calidris mauri</u>
	Marbled godwit	<u>Limosa fedoa</u>
	Hudsonian godwit	<u>Limosa haemastica</u>
	American avocet	<u>Recurvirostra americana</u>
	Wilson's phalarope	<u>Steganopus tricolor</u>
	Common snipe	<u>Capella gallinago</u>
	California gull	<u>Larus californicus</u>
	Forster's tern	<u>Sterna forsteri</u>
STRIGIFORMES (owls)	Western burrowing owl	<u>Speotyto cunicularia</u>
	Short-eared owl	<u>Asio flammeus</u>
	Great horned owl	<u>Bubo virginianus</u>
	Long-eared owl	<u>Asio otus</u>
	Screech owl	<u>Otus asio</u>
	Saw-whet owl	<u>Aegolius acadicus</u>
CAPRIMULGIFORMES (goatsuckers)	Poor-will	<u>Phalaenoptilus nuttalli</u>
	Common nighthawk	<u>Chordeiles minor</u>
APODIFORMES (Swifts, hummingbirds)	White-throated swift	<u>Aeronautes saxatalis</u>
	Broad-tailed hummingbird	<u>Selasphorus platycercus</u>
	Calliope hummingbird	<u>Stellula calliope</u>
CORACIIFORMES (Kingfishers)	Belted kingfisher	<u>Megaceryle alcyon</u>
PICIFORMES (Woodpeckers)	Common flicker	<u>Colaptes auratus</u>
	Red-headed woodpecker	<u>Melanerpes erythrocephalus</u>
	Hairy woodpecker	<u>Dendrocopos villosus</u>
	Downy woodpecker	<u>Dendrocopos pubescens</u>
PASSERIFORMES (Perching birds)		
Family: Tyrannidae (tyrant flycatchers)		
	Eastern kingbird	<u>Tyrannus tyrannus</u>
	Western kingbird	<u>Tyrannus verticalis</u>
	Cassin's kingbird	<u>Tyrannus vociferans</u>
	Say's phoebe	<u>Sayornis saya</u>
	Western flycatcher	<u>Empidonax difficilis</u>
	Western wood pewee	<u>Contopus sordidulus</u>
	Olive-sided flycatcher	<u>Nuttallornis borealis</u>
	Least flycatcher	<u>Empidonax minimus</u>
	Hammond's flycatcher	<u>Empidonax hammondi</u>
	Dusky flycatcher	<u>Empidonax oberholseri</u>
	Traill's flycatcher	<u>Empidonax traillii</u>
Family: Alaudidae (larks)		
	Horned lark	<u>Eremophila alpestris</u>
Family: Hirundinidae (swallows)		
	Tree swallow	<u>Iridoprocne bicolor</u>
	Rough-winged swallow	<u>Stelgidopteryx ruficollis</u>
	Bank swallow	<u>Riparia riparia</u>
	Barn swallow	<u>Hirundo rustica</u>
	Cliff swallow	<u>Petrochelidon pyrrhonota</u>
	Violet-green swallow	<u>Tachycineta thalassina</u>
	Purple martin	<u>Progne subis</u>
Family: Corvidae (jays, magpies, and crows)		
	Blue jay	<u>Cyanocitta cristata</u>
	Pinyon jay	<u>Gymnorhinus cyanocephalus</u>
	Black-billed magpie	<u>Pica pica</u>
	Common crow	<u>Corvus brachyrhynchos</u>
	Common raven	<u>Corvus corax</u>
Family: Paridae (chickadees, titmice, etc.)		
	Black-capped chickadee	<u>Parus atricapillus</u>
Family: Sittidae (nuthatches)		
	Red-breasted nuthatch	<u>Sitta canadensis</u>
	White-breasted nuthatch	<u>Sitta carolinensis</u>
	Pygmy nuthatch	<u>Sitta pygmaea</u>
Family: Troglodytidae (wrens)		
	House wren	<u>Troglodytes aedon</u>
	Rock wren	<u>Salpinctes obsoletus</u>

Table 31 Continued

Order/Family	Common Name	Scientific Name
Family: Mimidae (mockingbirds and thrashers)		
	Mockingbird	<u>Mimus polyglottos</u>
	Gray catbird	<u>Dumetella carolinensis</u>
	Brown thrasher	<u>Toxostoma rufum</u>
	Sage thrasher	<u>Oreoscoptes montanus</u>
Family: Turdidae (thrushes, solitaires, and bluebirds)		
	American robin	<u>Turdus migratorius</u>
	Hermit thrush	<u>Catharus guttatus</u>
	Swainson's thrush	<u>Catharus ustulatus</u>
	Veery	<u>Catharus fuscescens</u>
	Mountain bluebird	<u>Sialia currucoides</u>
	Townsend's solitaire	<u>Myadestes townsendi</u>
	Western bluebird	<u>Sialia mexicana</u>
	Eastern bluebird	<u>Sialia sialis</u>
Family: Fringillidae (grosbeaks, finches, sparrows and buntings)		
	House finch	<u>Carpodacus mexicanus</u>
	Gray-crowned rosy finch	<u>Leucosticte tephrocotis</u>
	Purple finch	<u>Carpodacus purpureus</u>
	Black rosy finch	<u>Leucosticte atrata</u>
	Common redpoll	<u>Acanthis flammea</u>
	Pine siskin	<u>Spinus pinus</u>
	American goldfinch	<u>Spinus tristis</u>
	Red crossbill	<u>Loxia curvirostra</u>
	Green-tailed towhee	<u>Chlorura chlorura</u>
	Rufous-sided towhee	<u>Pipilo erythrophthalmus</u>
	Lark bunting	<u>Calamospiza melanocorys</u>
	Savannah sparrow	<u>Passerculus sandwichensis</u>
	Grasshopper sparrow	<u>Ammodramus savannarum</u>
	Baird's sparrow	<u>Ammodramus bairdii</u>
	Vesper sparrow	<u>Poocetes gramineus</u>
	Lark sparrow	<u>Chondestes grammacus</u>
	Cassin's sparrow	<u>Aimophila cassinii</u>
	Black-throated sparrow	<u>Amphispiza bilineata</u>
	Sage sparrow	<u>Amphispiza belli</u>
	Slate-colored junco	<u>Junco hyemalis</u>
	White-winged junco	<u>Junco aikenii</u>
	Gray-headed junco	<u>Junco caniceps</u>
	Tree sparrow	<u>Spizella arborea</u>
	Chipping sparrow	<u>Spizella passerina</u>
	Clay-colored sparrow	<u>Spizella pallida</u>
	Brewer's sparrow	<u>Spizella breweri</u>
	Harris' sparrow	<u>Zonotrichia querula</u>
	White crowned sparrow	<u>Zonotrichia leucophrys</u>
	Lincoln's sparrow	<u>Melospiza lincolnii</u>
	Song sparrow	<u>Melospiza melodia</u>
	McCrown's longspur	<u>Calcarius mccownii</u>
	Lapland longspur	<u>Calcarius lapponicus</u>
	Chestnut-collared longspur	<u>Calcarius ornatus</u>
	Black-headed grosbeak	<u>Pheucticus melanocephalus</u>
	Evening grosbeak	<u>Hesperiphona vespertina</u>
	Blue grosbeak	<u>Guiraca caerulea</u>
	Lazuli bunting	<u>Passerina amoena</u>
	Dickcissel	<u>Spiza americana</u>
Family: Motacillidae (pipits and wagtails)		
	Sprague's pipit	<u>Anthus spragueii</u>
Family: Bombycillidae (waxwings)		
	Bohemian waxwing	<u>Bombycilla garrulus</u>
	Cedar waxwing	<u>Bombycilla cedrorum</u>

Table 31 Continued

Order/Family	Common Name	Scientific Name
Family: Laniidae (shrikes)	Northern shrike	<u>Lanius excubitor</u>
	Loggerhead shrike	<u>Lanius ludovicianus</u>
Family: Sturnidae (starlings)	Starling	<u>Sturnus vulgaris</u>
Family: Vireonidae (vireos)	Red-eyed vireo	<u>Vireo olivaceus</u>
	Warbling vireo	<u>Vireo gilvus</u>
	Solitary vireo	<u>Vireo solitarius</u>
Family: Parulidae (warblers)	Orange-crowned warbler	<u>Vermivora celata</u>
	Virginia's warbler	<u>Vermivora virginiae</u>
	Yellow warbler	<u>Dendroica petechia</u>
	Yellow-rumped warbler	<u>Dendroica coronata</u>
	Townsend's warbler	<u>Dendroica townsendi</u>
	Chestnut-sided warbler	<u>Dendroica pensylvanica</u>
	Blackpoll warbler	<u>Dendroica striata</u>
	Northern water thrush	<u>Seiurus noveboracensis</u>
	MacGillivray's warbler	<u>Oporornis tolmiei</u>
	Common yellow throat	<u>Geothlypis trichas</u>
	Yellow breasted chat	<u>Icteria virens</u>
	Oven bird	<u>Seiurus aurocapillus</u>
	Wilson's warbler	<u>Wilsonia pusilla</u>
	Canada warbler	<u>Wilsonia canadensis</u>
	American redstart	<u>Setophaga ruticilla</u>
	Black-throated gray warbler	<u>Dendroica nigrescens</u>
Family: Ploceidae (weaver finches)	House sparrow	<u>Passer domesticus</u>
Family: Icteridae (blackbirds, orioles, etc.)	Western meadowlark	<u>Sturnella neglecta</u>
	Red-winged blackbird	<u>Agelaius phoeniceus</u>
	Yellow-headed blackbird	<u>Xanthocephalus xanthocephalus</u>
	Orchard oriole	<u>Icterus spurius</u>
	Northern oriole	<u>Icterus galbula</u>
	Brewer's blackbird	<u>Euphagus cyanocephalus</u>
	Common grackle	<u>Quiscalus quiscula</u>
	Brown-headed cowbird	<u>Molothrus ater</u>
	Bobolink	<u>Dolichonyx oryzivorus</u>
Family: Thraupidae (tanagers)	Western tanager	<u>Piranga ludoviciana</u>

Table 32
List of Known and Probable Fish Species
Found in the Study Area*

<u>Common Name</u>	<u>Scientific Name</u>
Brook trout	<u>Salvelinus fontinalis</u>
Brown trout	<u>Salmo trutta</u>
Rainbow trout	<u>Salmo gairdneri</u>
Largemouth bass	<u>Micropterus salmoides</u>
Smallmouth bass	<u>Micropterus dolomieu</u>
Green sunfish	<u>Lepomis cyanellus</u>
Bluegill	<u>Lepomis macrochirus</u>
Rock bass	<u>Ambloplites rupestris</u>
Channel catfish	<u>Ictalurus punctatus</u>
Black bullhead	<u>Ictalurus melas</u>
Stonecat	<u>Noturus flavus</u>
Walleye	<u>Stizostedion vitreum</u>
Sauger	<u>Stizostedion canadense</u>
Northern pike	<u>Esox lucius</u>
Yellow perch	<u>Perca flavescens</u>
River carpsucker	<u>Carpoides carpio</u>
Goldeye	<u>Hiodon alosoides</u>
Longnose sucker	<u>Catostomus catostomus</u>
White sucker	<u>Catostomus commersoni</u>
Mountain sucker	<u>Pantosteus platyrhynchus</u>
Northern redhorse	<u>Moxostoma macrolepidotum</u>
Carp	<u>Cyprinus carpio</u>
Creek chub	<u>Semotilus atromaculatus</u>
Lake chub	<u>Hybopsis plumbea</u>
Flathead chub	<u>Hybopsis gracilis</u>
Plains minnow	<u>Hybognathus placitus</u>
Sand shiner	<u>Notropis stramineus</u>
Golden shiner	<u>Notomigonus crysoleucas</u>
Fathead minnow	<u>Pimephales promelas</u>
Longnose dace	<u>Rhinichthys cataractae</u>
Plains killifish	<u>Fundulus kansae</u>
Plains topminnow	<u>Fundulus sciadicus</u>
Brassy minnow	<u>Hybognathus hankinsoni</u>
Silvery minnow	<u>Hybognathus nuchalis</u>
Flathead catfish	<u>Pylodictus olivaris</u>

Officially considered to be rare in the State of Wyoming are:

Shovelnose sturgeon	<u>Scaphirhynchus platyrhynchus</u>
Pearl dace	<u>Semotilus margarita</u>
Finescale dace	<u>Phoxinus neogacus</u>
Sturgeon Chub	<u>Hybopsis gelida</u>
Goldeye	<u>Hiodon alosoides</u>

*Includes portions of the Belle Fourche, Cheyenne, Little Missouri, Little Powder and Powder River drainages.

RECREATION
Supporting Data

Table 33

WYOMING
Existing Outdoor Recreation Area Inventory

Annual Visits	County	Area Name	Ownership	Admin.	-----Land-----			-----Water-----	
					Undeveloped	Developed	Marsh	Water	Total
5,900	Campbell	Nat'l Resource Lands	Federal	BLM	223,318				223,318
		Thunder Basin Nat'l Grassland	"	USFS	157,600			405	158,005
		Edwards Rs. Public	State	State	58				58
	"	Fish Area							
	"	Gillette St. Wildlife Area	"	"	18			40	58
	"	Dalby Mem Pk & Lake	County	County		60			60
	"	Gillette City Park	City	City		10			10
	Converse	Nat'l Resource Land	Federal	BLM	128,866				128,866
4,500		Thunder Basin NG	"	USFS	185,513			195	185,708
13,150		Medicine Bow NF	"	"	78,797	4		470	79,271
10,000	"	Fort Fetterman	State	Wyoming Rec. Comm	60				60
	"	Ayers Park (Nat. Bridge)	County	County	20				20
	"	Boxelder Co. Park	"	"		2			2
	"	Douglas Riverside Pk	City	City		3			3
	"	Douglas Wash. Park	"	"		9			9
	"	Glenrock City Pk.	"	"		10			10
50	Crook	Nat'l Resource Lands	Federal	BLM	103,025				103,025
		Thunder Basin NG	"	USFS	302				302
66,200	"	Black Hills Nat'l For.	"	"	163,874	8		342	164,224
150,916	"	Devils Tower NM	"	NPS	1,326	21			1,347
	"	Keyhole Reservoir	"	B/R	6,740			9,394	16,134
91,516	"	Keyhole Res. Rec. Area	"	Wy Rec. Comm.	6,700			Keyholes	6,700
	"	Sand Creek	State	G & F	20				20
	"	Moorcroft Campground	City	City		2			2
	"	Moorcroft Noonan	"	"		1			1
		Picnic Ground							
	"	Sundance Picnic Grnd	"	"		2			2
	Johnson	Nat'l Resource Lands	Federal	BLM	202,084				202,084
3,000		Cloud Creek Rec. Complex	"	"	141,255				141,255
	"	Hole-in-the-Wall	"	BLM					195,070
7,000		Rec. Complex							
	"	Bighorn Nat'l For.	"	USFS	327,909	201		3,491	331,601

Annual Visits	County	Area Name	Ownership	Admin.	-----Land-----		-----Water-----	
					Undeveloped	Developed	Marsh	Total
	Johnson	Ft. Phil Kearny NHL	"	"		3		3
	"	Ft. Reno Hist. Site	"	"		14		14
	"	Buffalo City Park	City	City	8			8
	"	Buffalo Municipal Campground	"	"		6		6
	"	Cold Springs Campground	"	"	20			20
	"	Cold Springs Picnic Ground	"	"	20			20
	Natrona	Nat'l Resource Lands	Federal	BLM	1,369,156			1,369,156
6,000	"	Muddy Mtn. Rec. Lands	"	"	1,260			1,250
26,500	"	Trapper Rte. Canoe Trail (N. Platte R.)	"	"	3,264		(50mi)	3,264
5,000	"	Pathfinder NWR	"	BSP&W	12,644	10		12,654
1,800	"	Medicine Box NF	"	USFS	5,445		90	5,535
	"	Evansville St. Rec. Ar.	State	G & FC	105	5		110
30,000	"	Independence Rock NHL	"	Wyoming Rec Comm	955	5		960
369,275	"	Alcova Res. Campground	Federal	Co. Pk. Bd.	3,237		2,500	5,737
	"	Archery Range	County	"	112			112
	"	Beartrap Meadow Park	"	"	160			160
	"	Casper Mtn. Pk.	"	"	480			480
14,580	"	Gray Reef Res.	Federal	"	43		181	224
60,368	"	Pathfinder Res.	"	"	26,417	59	15,528	41,945
	"	Rotary Park	County	"		2		2
	"	Casper Adams Park	City	City		2		2
	"	Casper City Park	"	"		4		4
	"	Convell Park (Casper)	"	"		2		2
	"	Casper Eastdale Park	"	"		4		4
	"	Casper "F" St. Park	"	"		2		2
	"	Casper Huber Park	"	"		6		6
	"	Casper Manor Hgts. Pk.	"	"		3		3
	"	Casper Marion Criner Pk.	"	"		1		1
	"	Casper Mike Sedar Park	"	"	65			65
	"	Casper Nancy English Pk.	"	"		15		15
	"	Casper Randalette Pk.	"	"		1		1

Table 33 Continued

Table 33 Continued

Annual Visits	County	Area Name	Ownership	Admin.	Land		Water	
					Undeveloped	Developed	Marsh	Total
	Natrona	Casper River View Pk	City	City		2		2
	"	Casper So. Ridge Pk.	"	"		2		2
	"	Casper Veterans Pk.	"	"		1		1
	"	Casper Washington Pk.	"	"		26		26
	"	Casper Westwood Pk.	"	"		3		3
	"	Casper Yesness Pk.	"	"		7		7
	"	Evansville Park	"	"		1		1
	"	Fort Casper	"	"		30		30
	"	North Casper Park	"	"	93			93
	"	Camp Wyoming B.A.	Private	Private	10			10
	"	Sun (Tom) Ranch NHL	"	"	960			960
	Niobrara	Nat'l Resource Lands	Federal	BLM	159,704			159,704
	"	Lance Creek Fossil	Fed-St-Pvt.	BLM-State	368,640(approx)			368,640
	"	Area NHL						
100	"	Thunder Basin NG	Federal	USFS	840			840
	"	Lusk Pest Area	State	Hwy. Dept.		15		15
	"	North Side Comprnd.	City	City		1		1
	"	Northside Picnic Grnd	"	"		1		1
	"	Lusk Was. Mem. Park	"	"		1		1
198,600	Sheridan	Nat'l Resource Lands	Federal	BLM	50,668			50,668
6,000	"	Bighorn Nat'l Forest	"	USFS	399,697	340	2,312	402,349
	"	Connor Battlefield	"	"				
	"	Hist. Site	State	Wyoming Rec. Comm.		1.2		1.2
	"	Tongue R. Pub. Fish Ar.	"	G & F	270		26	296
	"	Amsden Ork. St. W. Ref.	"	G & F	2,589		1	2,590
	"	Kerns St. Wildlife Ref.	"	"	5,142			5,142
	"	Sheridan Bird Farm	Local	"	47			47
	"	Sheridan Co. St. Wild. life Refuge	"	"	7,731			7,731
	"	Sheridan Info Ctr.	State	Hwy. Dept.		25		25
	"	Sheridan Kendrick Pk	City	City		12		12
	"	Sheridan Wash. Park	"	"		1		1
	"	Sheridan Inn NHL	Private	Private		10		10

Annual Visits	County	Area Name	Ownership	Admin.	-----Land-----			-----Water-----		
					Undeveloped	Developed	Marsh	Water	Total	Total
5,350	Weston	Nat'l Resource Lands	Federal	BLM	78,684				78,684	
	"	Thunder Basin NG	"	USFS	226,940			505	227,445	
1,600	"	Black Hills Nat'l For.	"	"	6,364				6,364	
	"	Mallo Campground	County	County	153				153	
	"	Newcastle Dow Park	City	City		2			2	
	"	Upton City Emprnd.	"	"	25				25	
		STATE TOTAL			4,654,503	956.20		35,480	4,690,939.20	

Source: Northern Great Plains Resource Program

Table 33 Continued

Table 34

MONTANA
Existing Outdoor Recreation Area Inventory

Annual Visits	County	Area Name	Ownership	Admin	Land		Water		Total
					Undeveloped	Developed	Mars	Water	
	Big Horn	Nat'l Resource Lands	Federal	BLM	27,208				27,208
	"	Crow Indian Reserva.	Tribal	BIA	66,676	75		583	67,334
	"	"	Federal	BIA	392	5		750	1,147
118,836	"	Big Horn Canyon NRA	Federal	NPS	2,110	1,090		5,760	8,960
387,717	"	Custer Battlefield	Federal	NPS	749	16			765
		Nat'l Monument							
5,000	"	Chief Plenty Coups	State	F & G	190	4			194
		Memorial State Mon.							
3,500	"	Arapoosh Fish Access	"	"	93				93
		Area							
5,000	"	Bighorn R. " Area	"	"	78				78
16,000	"	Two Leggings Fish Access Area	"	"	34				34
	"	Tongue River Reservoir	"	State	352			5,195	5,547
	Carter	Nat'l Resource Lands	Federal	BLM	512,333				512,333
9,850	"	Custer Nat'l Forest	Federal	USFS	89,377	23			89,400
3,000	"	Medicine Rocks St. Pk.	State	F & G	300	20			320
	Powder River	Nat'l Resource Lands	Federal	BLM	257,836				257,836
	"	Custer Nat'l Forest	"	USFS	341,933	13			341,946

Source: Northern Great Plains Resource Program

Table 35

Summary of Planned Future Development

Type of Development -- Local	Fiscal Year	Amount
<u>Converse County</u>		
1. Douglas: Washington Park Improvements--install playground equipment, fencing of play area. (226)	1973*	\$ 6,500.00*
2. Converse County: Ayre's Natural Bridge--site improvements, landscaping, installation of fencing, area lights, sprinkler system, graveling roadways. (233)	1975*	8,300.00*
County Total		14,800.00
<u>Natrona County</u>		
3. Natrona County: East End Road--(parks inter-connect) complete road construction.	1972-1977	100,000.00
4. Casper: Nancy English Park--clean & grade North Creek area, install irrigation system for entire park, plant grass in north portion. (77)	1973*	13,994.40*
5. Casper: Automate golf course.	1973-1977	49,000.00
6. Casper: Bicycle trails.	1974	27,000.00
7. Edgerton: Town Park--construct dam, install fence, construct trap & rifle range, planning & engineering. (228)	1974*	23,500.00*
8. Midwest: Swimming Pool--improvement of existing swimming pool, filtration system, chlorination equipment, pool & first-aid equipment, building, septic tank, site improvements, planning & engineering. (232)	1974*	11,100.00*
9. Natrona County: Alcova Canyon--development of public use area, construction of roads & parking areas, develop trails for canyon overlook, construct & install toilets, beach shelter, boat ramp, informational and directional signs, site planning & engineering. (192)	1974*	17,385.00*
10. Casper: Develop historical site.	1974-1976	15,000.00
11. Casper: River front development.	1974-1976	80,000.00
12. Casper: Red Butte Battle Site	1974-1977	11,000.00
13. Casper: Golf course expansion (9 holes)	1974-1977	60,000.00
14. Edgerton: Lions Club Park--landscaping, picnic table & shelter, water hook-up, signs & perimeter fencing. (263)	1974*	1,800.00*
15. Natrona County: Archery Range--clean flight lines, construct trail, construct shooting stake positions, trail guides, bow racks & benches, construct access road, picnic area, sanitary facilities, trailer park area, construct parking area, shelter house/utility building, playground area, installation of playground equipment, fencing, gates, interpretive signs & water development. (159)	1975*	39,409.86*
16. Casper: North Park No. 2--install backstop & dugouts at North field. (259)	1975*	6,000.00
17. Natrona County: Ponderosa-Winter Recreation Area	1975	17,500.00
18. Casper: Park in Southeast Casper.	1975	25,000.00
19. Casper: Automation of park areas	1975-1976	18,000.00
20. Casper: Washington Park No. 2--backstop & scoreboard for ball field, sidewalk, landscaping, planning & engineering. (261)	1976*	10,000.00
21. Natrona County: Muddy Mountain Park (BLM transfer) 10 picnic units.	1976	Unknown
22. Natrona County: Crimson Dawn-Memorial Preserve--nature trails, fence.	1977	75,000.00
23. Casper: City Park Improvements. (Cheyenne Processing).		5,130.00*
24. Casper: Eastdale Park Improvements. (Cheyenne Processing).		12,298.50*
25. Casper: Meadow Park Improvements. (Cheyenne Processing).		1,885.00*
26. Casper: Mike Sedar Park Improvements No. 2. (Cheyenne Processing).		33,996.78*
27. Casper: Municipal Golf Course Improvements. (Cheyenne Processing).		78,420.38*
28. Casper: Westwood Improvements. (Cheyenne Processing).		5,887.00*
County Total		738,306.92

Table 35 (Cont'd)

Type of Development -- Local	Fiscal Year	Amount
<u>Niobrara County</u>		
29. Lusk: Golf Course Acquisition & Development--develop picnic facilities, playground equipment, tennis courts, trap shoot area, fishing improvements, landscaping, fencing, sanitary facilities, parking, lighting, water including irrigation facilities. (Acquisition Separate) (234)	1975*	\$223,650.00*
County Total		223,650.00
<u>Campbell County</u>		
30. Gillette: Dalbey Park--site improvements, roads, parking, landscaping, ice skating facilities, restroom facilities, water system, lighting, planning & engineering. (256)	1977*	35,000.00*
31. Campbell County: Pioneer Stocktrail Park. (Cheyenne Processing).		32,164.00*
County Total		67,164.00
<u>Crook County</u>		
32. Crook County: Multiple-Use Recreation Area & Rodeo Arena.	1972-1977	Unknown
33. Crook County: Washington Park--earthwork, construction and installation of water, sewer, sanitary facilities, storage, foot bridge, parking area, picnic facilities, roads & landscaping. (185)	1973*	51,494.85*
34. Hulett: Hulett Recreation Area--rodeo arena, fencing, chutes, lighting, water & sewer system, utility building, sanitary facilities. (Acquisition Separate).	1975	60,212.00
County Total		111,706.85
<u>Johnson County</u>		
35. Buffalo: Frank Prosinski Park--construct dugouts, announcers booth, install public address system, planning & engineering. (266)	1974*	3,600.00*
36. Buffalo: Swimming Pool.	1974	100,000.00
37. Kaycee: Barnum School Recreation Area. (Cheyenne Processing).		2,525.00*
County Total		106,125.00
<u>Sheridan County</u>		
38. Sheridan: Sheridan Golf Course--underground sprinkler system to #1 & #9 fairways, install underground sprinkler system on 4 additional fairways, install 4 grass greens, install underground sprinkler system on 3 remaining fairways, install 5 remaining grass greens. (198)	1973*	200,000.00*
39. Sheridan: Thorne Rider Park--renovation of existing dugouts, develop Babe Ruth baseball field, picnic facilities, tennis courts, horse-shoe courts, playground area & wading pool, support facilities, sidewalk, bleachers, dugouts, playground equipment, parking, road with curb & gutter, landscaping, sprinkler system, water, sewer, electricity, gas service, fencing, gates, entry booth, restroom/storage facilities, lighting, speaker system, scoreboard, planning and engineering. (243)	1976*	315,000.00
40. Sheridan: Golf course, sheltered acres (development) and native animal display (fencing).	1973-1977	Unknown
County Total		515,000.00
<u>Weston County</u>		
41. Newcastle: Dow Park Improvements--playground equipment, drinking fountain, trees, shrubs, landscaping, drainage structure and curb & gutter and surface paving. (49)	1973*	33,131.99*
County Total		33,131.99

Source: Wyoming Recreation Commission, Wyoming Statewide Comprehensive Outdoor Recreation Plan, 1973.

Recreation Facility	NRPA Standards	1970 Needs (12,957)	1975 Needs (14,396)	1980 Needs (28,956)	1985 Needs (44,278)	1990 Needs (56,959)
Tennis Courts	1/ 2,000 p.	6	7	14	22	28
Baseball Diamonds (lighted)	1/ 6,000 p.	2	2	5	7	9
Baseball Diamonds (unlighted)	1/ 4,000 p.	3	3	7	11	14
Swimming Pool	3% pop. x 20=s.f.	7,740*(2 pools)	8,637*(3 pools)	17,373*(6 pools)	25,566*(10 pools)	34,175*(12 pools)
Spray Pools	1/ 4,000 p.	3	3	7	11	14
Golf Courses	1/20,000 p.	9 holes	9 holes	18 holes	36 holes	45 holes
Shelter Buildings	1/ 4,000 p.	3	3	7	11	14
Picnic Area	5% pop./30=acres	21.6 acres	24 acres	48 acres	74 acres	95 acres
Volleyball Court	1/ 6,000 p.	2	2	5	7	9
Horseshoe Court	1/ 2,000 p.	6	7	14	22	28
Ice Skating Area	1/ 2,500 p.	5	6	11	18	23
Tetherball Poles	1/ 5,000 p.	10	12	22	36	46
Basketball Goals	1/ 1,500 p.	9	10	19	29	37
Running Tracks	1/15,000 p.	0	1	2	3	4
Camping Area	1 acre/1,000 p.	13 acres	14 acres	29 acres	44 acres	57 acres
Recreation Center	1/20,000 p.	1	1	1	2	3
Required Park Areas						
Developed Urban Parks	1 ac./100 p.	129.57 acres	143.96 acres	289.56 acres	442.78 acres	569.59 acres
Informal Rural Parks	1 ac./100 p.	129.57 acres	143.96 acres	289.56 acres	442.78 acres	569.59 acres
All Parks		259.14	287.92	579.12	885.56	1,139.18

* These pool needs are based on an average size pool and may be reduced because of weather conditions or through the use of larger pools.

Source: Campbell County Recreation Study.

Table 35a
Future Facility and Park Area Projections

Region and County	ATTENDING ATHLETIC EVENTS			BOATING AND CANOEING			CAMPING		
	1970	1990	% Inc. 90 over 70	1970	1990	% Inc. 90 over 70	1970	1990	% Inc. 90 over 70
Converse	16,381	18,529	13	4,635	8,210	77	24,366	41,068	68
Natrona	80,057	136,236	70	115,174	138,291	20	123,802	182,290	47
Niobrara	5,274	5,480	4	6,827	5,389	-21	11,219	14,396	28
Total	101,712	160,245	57	126,636	151,890	20	159,387	237,754	49
Campbell	10,719	31,986	198	21,783	43,485	100	40,160	80,852	101
Crook	7,934	9,874	24	11,876	17,626	48	40,035	68,082	70
Johnson	12,007	15,725	31	4,666	10,974	135	64,328	110,332	71
Sheridan	25,367	38,049	50	13,211	25,341	92	85,935	125,139	46
Weston	8,782	14,218	62	11,728	18,836	61	23,351	40,384	73
Total	64,809	109,852	69	63,264	116,262	84	253,809	424,789	67
Region and County	FISHING			GOLFING			HIKING		
	1970	1990	% Inc. 90 over 70	1970	1990	% Inc. 90 over 70	1970	1990	% Inc. 90 over 70
Converse	41,588	61,927	49	13,557	23,785	74	26,017	38,263	47
Natrona	309,044	420,580	36	110,153	225,614	105	127,185	187,926	47
Niobrara	14,691	14,167	-4	6,348	8,782	38	7,447	12,710	70
Total	365,323	496,674	36	130,058	258,181	99	160,649	238,899	48
Campbell	90,050	187,855	109	15,876	55,240	248	23,200	54,491	138
Crook	55,549	88,029	58	3,115	9,633	209	25,339	46,927	85
Johnson	70,720	99,234	40	9,841	20,510	108	38,956	57,377	47
Sheridan	163,380	193,383	18	33,464	62,603	87	64,423	85,034	31
Weston	54,060	68,131	26	13,544	24,672	82	15,731	31,736	101
Total	503,663	646,632	26	75,839	172,658	128	167,649	275,565	64

Table 36

Estimated Total Recreation Participation by Region, 1970 and 1990

Table 36 Continued

Region and County	HUNTING			ICE SKATING			PICNICKING		
	1970	1990	% Inc. 90 over 70	1970	1990	% Inc. 90 over 70	1970	1990	% Inc. 90 over 70
Converse	13,303	14,497	9	3,625	5,008	a	22,760	35,601	56
Natrona	83,955	126,922	51	31,302	43,380	a	67,288	102,653	52
Niobrara	2,055	3,392	65	1,786	2,448	a	21,966	34,905	58
Total	99,313	144,811	46	36,713	50,836	a	112,014	173,159	54
Campbell	9,405	27,974	197	7,912	10,943	a	127,633	225,314	76
Crook	11,642	10,841	-7	2,769	3,826	a	108,784	184,111	69
Johnson	15,409	16,157	5	3,412	4,726	a	59,801	98,699	65
Sheridan	57,057	52,575	18	10,900	15,107	a	68,969	107,064	55
Weston	16,930	17,358	3	3,850	5,317	a	18,564	31,881	71
Total	110,443	124,905	13	28,843	39,919	a	383,751	647,069	68
Region and County	RODEOS			SIGHTSEEING & PLEASURE DRIVES			SKIING		
	1970	1990	% Inc. 90 over 70	1970	1990	% Inc. 90 over 70	1970	1990	% Inc. 90 over 70
Converse	20,527	30,125	46	40,706	49,150	20	0	4,358	00
Natrona	40,899	58,755	43	366,723	499,835	36	52,888	95,635	80
Niobrara	2,067	2,142	-18	16,929	16,973	1	208	1,704	719
Total	64,036	91,022	42	424,358	565,958	33	53,096	101,697	91
Campbell	12,511	24,354	94	39,404	107,413	172	731	12,486	1608
Crook	7,110	5,505	-33	30,674	33,471	9	426	3,330	681
Johnson	11,195	13,056	16	35,787	46,893	31	8,548	11,973	40
Sheridan	25,048	35,792	42	150,842	161,173	6	17,741	27,754	56
Weston	8,214	7,523	-9	31,832	47,082	47	3,784	8,329	120
Total	64,078	86,230	34	288,539	396,032	37	31,230	63,872	104

Region and County	SLEDDING & TOBOGGANING			SNOWMOBILING			SOFTBALL & BASEBALL		
	1970	1990	% Inc. 90 over 70	1970	1990	% Inc. 90 over 70	1970	1990	% Inc. 90 over 70
Converse	1,518	2,096	a	4,670	2,888	a	8,935	12,385	a
Natrona	13,104	18,159	a	40,325	63,369	a	77,149	107,287	a
Niobrara	747	1,025	a	2,301	1,129	a	4,402	6,053	a
Total	15,369	21,280	a	47,296	67,386	a	90,486	125,725	a
Campbell	3,312	4,581	a	10,192	8,274	a	19,500	27,065	a
Crook	1,159	1,602	a	3,567	2,206	a	6,823	9,462	a
Johnson	1,428	1,978	a	4,395	7,934	a	8,409	11,689	a
Sheridan	4,563	6,324	a	14,041	18,390	a	26,864	37,363	a
Weston	1,612	2,226	a	4,960	5,519	a	9,490	13,150	a
Total	12,074	16,711	a	37,155	42,323	a	71,086	98,729	a
Region and County	SWIMMING			WATER SKIING			TENNIS		
	1970	1990	% Inc. 90 over 70	1970	1990	% Inc. 90 over 70	1970	1990	% Inc. 90 over 70
Converse	24,978	29,832	19	2,636	4,078	54	2,109	2,940	a
Natrona	207,896	259,717	24	35,451	52,095	46	18,209	25,470	a
Niobrara	16,067	20,624	28	382	964	152	1,039	1,437	a
Total	248,941	310,173	24	38,469	51,137	48	21,357	24,847	a
Campbell	54,127	100,664	85	6,351	14,986	135	4,603	6,425	a
Crook	29,494	49,596	68	2,415	4,408	82	1,611	2,246	a
Johnson	15,902	25,839	62	1,967	4,095	108	1,985	2,775	a
Sheridan	42,929	64,580	50	2,054	7,719	275	6,341	8,870	a
Weston	28,331	32,586	15	6,324	8,004	26	2,340	3,122	a
Total	170,783	273,265	60	18,111	39,212	116	16,880	23,438	a

Source: Wyoming, Wyoming Statewide Comprehensive Outdoor Recreation Plan, 1973
 This was one of five activities on the 1970 survey that was not included as a separate activity on the 1967 survey. Data were not available to allocate participation to the counties on the same basis as was done for those activities covered in the 1967 survey. Thus, the percentage increase for each county is the same as the estimated increase for the state (see Table VIII-16).

Table 36 Continued

SOCIO-ECONOMICS

Supporting Data

Population and Employment Projection Model

Background

Projections of population and employment used in this EIS were based on a predictive model developed originally by the Water Resources Institute of the University of Wyoming for the Northern Great Plains Resources Program (NGPRP), with more recent coal production estimates for Campbell and Converse Counties provided by the U.S. Geological Survey. These figures have been substituted into the model. The NGPRP Study has developed three alternative scenarios, each projecting a different coal production level for the eight counties of the Powder River Basin. Since coal development has been assumed to occur principally in Campbell and Converse Counties, the least additional development scenario of the NGPRP has been included in the population and employment projections of this report to provide a coal production base for each of the remaining six counties. The least additional development scenario assumes that no further coal development would take place other than that necessary to supply the future demand for coal within the Northern Great Plains Region (NGP) to fulfill contracts presently in existence or being negotiated for short term foreseeable NGP coal demands.

Assumptions

The population and employment figures used in this report serve only to indicate what may happen in the future based on several assumptions and the best possible available information. As it is impossible to predict accurately future outcomes, these population projections are only indicative and should not be understood as real future occurrences. The assumptions for population and employment forecasts are critical and a discussion and outline of these follow.

Many assumptions exist for both the export and residentiary sectors. The estimates by the USGS of coal production and number of power and coal gasification plants is crucial. Given productivity levels for workers in coal mining, coal gasification, and power plants by permanent and construction status, the basis has been established to develop coal-related employment as part of the export sector. Productivity levels have been provided by USGS and the University of Wyoming.

Uranium mining and milling operations and employment are predicted on a survey undertaken by the Wyoming Department of Economic Planning and Development (DEPAD). The DEPAD questionnaires resulted in specific information concerning future sites, expected timing, and anticipated employment of firms with development interests in the basin. Levels of petroleum and natural gas employment are contained in the NGPRP study. Employment for the remaining export sectors of agriculture, railroads, other mining and manufacturing is premised upon a continuation of historic trends for each of these sectors as observed and analyzed by the University of Wyoming.

Employment in the construction and residentiary sectors is based on the existing relationships of employment in these sectors to populations. Levels of employment for each of the residentiary sectors, i.e., construction, consumer services, business services and government and education, were derived as a function of population through a cross-sectional analysis using 1970 census data. Construction employment has been increased to account for employment associated with construction necessary for coal mining, coal gasification facilities and powerplants.

A final assumption having important regional repercussions is the residential location of the workforce and their families in the same county where the coal development activity occurs. This assumption may prove incorrect as employees may choose to commute long distances and possibly cross county boundaries. Because it is difficult to measure commuting patterns of a future workforce, the workforce has been assumed to reside in that county where it works. It is equally difficult to estimate their location within the county.

Methodology

The model establishes a historic relationship between employment in export and local industries and population, and projects these relationships forward in time when supplied with the appropriate data. Export industries are those employment sectors where the production of goods and services is intended for distribution to areas outside the region. Export employment includes agriculture, petroleum and natural gas, synthetic gas, coal mining, uranium mining and milling, power generation, other mining and other manufacturing. Local or residentiary industries are the secondary and indirect effects of employment in the export sector. Essentially, residentiary industries produce those goods and services consumed locally and include employment in construction, consumer services, business services and government and education.

The University of Wyoming predictive model emphasizes a mutual determination of population and employment. The model yields employment and associated population projections resulting from multipliers operating upon basic employment. The growth of the local or residentiary sector as influenced by initial expansion of the export sector has been designed to fluctuate and reflect the availability of labor in the region. The relationship between

employment and population has been established through a cohort survival model where migration has been determined endogenously based upon relative unemployment rates and per capita income levels. For the purposes of this report, initial population and employment values have been developed under birth rate assumptions consistent with the Census Series "E" projections.

Table 37

Population Density and Percent Urban Population
United States, Wyoming and Neighboring States
1970

<u>State or Area</u>	<u>Area*</u> <u>(Square Miles)</u>	<u>Population</u>	<u>Population</u> <u>per</u> <u>Square Mile</u>	<u>Percent</u> <u>Urban</u> <u>Population</u>
United States	3,548,974	203,184,772	57.3	73.5
Wyoming	97,411**	332,416	3.4	60.5
Montana	145,736**	694,409	4.8	53.4
Idaho	82,708**	713,008	8.6	34.1
South Dakota	76,378	666,257	8.7	44.5
Utah	82,339	1,059,273	12.8	80.4
Nebraska	76,612	1,483,791	19.4	61.5
Colorado	103,884	2,207,259	21.2	78.5

*Does not include inland water area

** Includes Yellowstone National Park

Source: U.S. Bureau of the Census, Census of Population, 1970

Table 38

Urban and Rural Population of Wyoming
1950 - 1970

<u>YEAR</u>	<u>TOTAL POPULATION</u>	<u>PERCENT URBAN*</u>	<u>PERCENT RURAL</u>
1900	92,531	28.8	71.2
1910	145,965	29.6	70.4
1920	194,402	29.4	70.6
1930	225,565	31.1	68.9
1940	250,742	37.3	62.7
1950	290,529	49.8	50.2
1960	330,066	56.8	43.2
1970	332,416	60.5	39.2

*Places with 2,500 people and more.

Source: U. S. Department of Commerce, Bureau of the Census,
Census of Population, 1970.

Table 39

Population Density: Wyoming Counties in Powder
River Basin, Region, State of Wyoming and United States
1970

	<u>Area</u> <u>(Square Miles)</u>	<u>Total</u> <u>Population</u>	<u>Population Per</u> <u>Square Mile</u>
Campbell	4,756	12,957	2.7
Converse	4,281	5,938	1.4
Crook	2,882	4,535	1.6
Johnson	4,175	5,587	1.3
Natrona	5,342	51,264	9.6
Niobrara	2,614	2,924	1.1
Sheridan	2,532	17,852	7.1
Weston	2,407	6,307	2.6
Region Total	28,989	107,364	3.7
Wyoming Total	97,203	332,416	3.4
U.S. Total	3,548,974	203,184,772	57.2

Source: U.S. Bureau of the Census, Census of Population,
1950 Through 1970.

<u>County or Area</u>	<u>Total Population</u>	<u>Percent Under 18 Yrs.</u>	<u>Percent 18-64 Yrs.</u>	<u>Percent 65 and over</u>	<u>Male %</u>	<u>Female %</u>
Campbell	12,957	41.1	54.2	4.7	51.8	48.2
Converse	5,938	35.9	51.3	12.8	50.0	50.0
Crook	4,535	38.3	53.1	8.6	50.1	49.9
Johnson	5,587	34.4	52.6	13.0	50.2	49.8
Natrona	51,264	37.2	55.3	7.5	49.3	50.7
Niobrara	2,924	30.9	53.6	15.5	48.9	51.1
Sheridan	17,852	30.7	53.4	15.9	49.8	50.2
Weston	6,307	39.3	51.3	9.4	50.3	49.7
Region Total	107,364	36.4	54.1	9.5	50.1	49.9
State Total	332,416	36.1	54.8	9.1	50.2	49.8

Source: U. S. Department of Commerce, Bureau of the Census, Census of Population, 1950 through 1970.

Table 40

Population Distribution by Age and Sex
Powder River Basin Region
1970

Table 41

Population Distribution by Ethnicity
Powder River Basin Region
1970

Area or County	White %	Black	%	Spanish %	Indian	%	Other	%	Total
Campbell	12,540 96.8	2	.02	293 2.3	97	0.7	25	0.2	12,957
Converse	5,793 97.6	----	---	95 1.6	29	0.5	21	0.3	5,938
Crook	4,523 99.7	----	---	----	10	0.2	2	0.1	4,535
Johnson	5,448 97.5	3	.05	102 1.8	22	0.2	12	0.2	5,587
Natrona	49,246 96.1	410	0.8	1,173 2.3	220	0.4	215	0.4	51,264
Niobrara	2,917 99.8	----	---	----	6	0.2	1	---	2,924
Sheridan	17,366 97.3	39	0.2	296 1.7	78	0.4	73	0.4	17,852
Weston	6,185 98.1	1	---	90 1.4	23	0.4	8	0.1	6,307
Region	104,018 96.9	455	0.4	2,049 1.9	485	0.5	357	0.3	107,364
Wyoming State	305,073 91.8	2,568	0.8	17,951 5.4	4,980	1.5	1,834	0.5	332,416

Source: U. S. Department of Commerce, Bureau of the Census, Census of Population, 1950 through 1970.

County or Area	Total No. of Persons 24 Yrs. Old & Over	4 Yrs. of High School or More No. %	4 Yrs. of College or More No. %	Median School Yrs. Completed
Campbell	6,126	3,593 58.7	387 6.3	12.2
Converse	3,383	2,128 62.9	314 9.3	12.3
Crook	2,414	1,514 62.7	223 9.2	12.3
Johnson	3,217	1,901 59.1	296 9.2	12.2
Natrona	26,449	18,034 68.2	3,506 13.3	12.5
Niobrara	1,832	1,008 55.0	88 4.8	12.0
Sheridan	10,861	6,547 60.3	1,214 11.2	12.3
Weston	3,320	1,892 57.0	247 7.4	12.2
Region	57,602	36,617 63.6	6,275 10.9	12.4
State	175,649	110,397 62.9	20,693 11.8	12.4
U.S.	-----	----- 52.3	----- 10.7	12.1

Source: U. S. Department of Commerce, Bureau of the Census, Census of Population, 1950 through 1970.

Table 42

Years of School Completed by Persons
25 Years Old and Over
Powder River Basin Region

Table 43

Location of Regional Population Growth
from 1970-1990 by County, Powder River Basin, Wyoming

County or Area	1970	1980	% 1970- 1980		1990	1980-1990		% 1980- 1990	1970-1990		% 1970- 1990
			1970-1980	Regional		Difference	Growth		Difference	Regional	
Campbell	12,957	32,200	19,243	53.0	50,400	18,200	78.1	37,443	62.8		
Converse	5,938	13,200	7,262	20.0	15,200	2,000	8.6	9,262	15.5		
Crook	4,535	4,500	- 35	- 0.1	4,600	100	0.4	65	0.1		
Johnson	5,587	7,500	1,913	5.3	7,400	- 100	-0.4	1,813	3.0		
Natrona	51,264	59,000	7,736	21.3	61,800	2,800	12.0	10,536	17.7		
Niobrara	2,924	2,800	- 124	- 0.3	2,600	- 200	-0.9	- 324	- 0.5		
Sheridan	17,852	18,200	348	1.0	18,500	300	1.3	648	1.1		
Weston	6,307	6,300	- 7	0.0	6,500	200	0.9	193	0.3		
Regional Total	107,364	143,700	36,336	100.0	167,000	23,300	100.0	59,636	100.0		

Table 44

Projected Population Levels and Projected
Population as a Percentage of 1970 Populations*

County, City or Area	1970	1980	1970-80	1985	1970-85	1990	1970-90
	Population	Population	pop. change Population	Population	pop. change Population	Population	pop. change Population
Campbell	12,957	32,200	148.5	45,600	251.9	50,400	289.0
Gillette	7,194	17,900	148.8	25,300	251.7	28,000	289.2
Rural	5,763	14,300	148.1	20,300	252.2	22,400	288.7
Converse	5,938	13,200	122.3	14,900	150.9	15,200	156.0
Douglas	2,677	6,000	124.1	6,700	150.3	7,000	161.5
Glenrock**	--	3,400	124.4	3,800	150.8	4,000	164.0
Rural	3,261	3,800	16.5	4,400	34.9	3,800	16.5
Crook	4,535	4,500	- 0.8	4,600	1.4	4,600	1.4
urban	--	--	--	--	--	--	--
Rural	4,535	4,500	0.8	4,600	1.4	4,600	1.4
Johnson	5,587	7,500	34.2	7,400	32.5	7,400	32.5
Buffalo	3,394	4,600	35.5	4,500	32.6	4,500	32.6
Rural	2,193	2,900	32.2	2,900	32.2	2,900	32.2
Natrona	51,264	59,000	15.1	60,400	17.8	61,800	20.6
Casper	39,361	45,300	15.1	46,400	17.9	47,500	20.7
Rural	11,903	13,700	15.1	14,000	17.6	14,300	20.1
Niobrara	2,924	2,800	- 4.2	2,700	- 7.7	2,600	- 11.1
Urban	--	--	--	--	--	--	--
Rural	2,924	2,800	- 4.2	2,700	- 7.7	2,600	- 11.1
Sheridan	17,852	18,200	1.9	18,300	2.5	18,500	3.6
Sheridan	10,856	11,100	2.2	11,100	2.2	11,300	4.1
Rural	6,994	7,100	1.5	7,200	2.9	7,200	2.9
Weston	6,307	6,300	- 0.1	6,300	- 0.1	6,500	3.1
Newcastle	3,432	3,400	- 0.9	3,400	- 0.9	3,500	2.0
Rural	2,865	2,900	1.2	2,900	1.2	3,000	4.7

Study Area Total 107,364 143,700 33.8 160,200 49.2 167,000 55.5

*City population is projected at the 1970 proportion of city to county population.

**1970 population of Glenrock was 1,515 which is below the U.S. Census urban place population requirements of 2,500.

Source: Projections developed by Water Resources Institute, University of Wyoming.

Employment Sector Breakdown

For purposes of analysis, employment is divided into ten sectors on a format identical to that used by the Water Resources Research Institute at the University of Wyoming. The ten sectors and their individual components are as follows:

1. Agriculture - includes agriculture, forestry, and fisheries employment.
2. Petrochemicals - includes petroleum, natural gas, and synthetic gas employment. (As of 1970, synthetic gas played no part in employment in any of the eight counties. Synthetic gas is synonymous with coal gasification.)
3. Coal mining - is coal mining employment only.
4. Uranium mining and milling - is uranium mining and milling operations employment only.
5. Power generation - is electric power generation employment only.
6. Other mining - is mining activity employment not related to the mining and processing of fuels. This includes mining of bentonite and other clays, stone, and sodium sulphate.
7. Other manufacturing - comprises two types of employment not related to fuels or construction: (a) processing of farm and forest products, and (b) a variety of miscellaneous manufacturing activities.
8. Railroads - is direct railroad employment only.

9. Construction - in addition to conventional construction employment, this includes sand and gravel mining, the manufacture of cement block and other nonmetallic building products, and the fabrication of structural steel.
10. Other residentiaries - comprises employment in three service sectors: (a) consumer service which exists primarily to serve local households, exclusive of governmental and educational services; (b) government and education services and public administration as well as military employment; and (c) business services which exist in large part to provide services to the business community.

Approach and Methodology for Socio-Economic Impact Analyses

In the analyses a development concept model was utilized to serve as the baseline for evaluating the impacts on a diverse number of socio-economic factors and variables. A graphic illustration of this process follows this description section.

The approach assumes that coal development triggers a complex set of actions. Coal development can be described in terms of (1) development, (2) energy conversion, and (3) distribution. The system's model becomes operational through mining operations, utilization processes and distribution systems. These interactions produce or cause effects. The effects in essence constitute the impacts. Some of these relate specifically to the area's socio-economic environment.

Incidence of the impacts is evidenced in three major socio-economic factor areas. These are: (1) population, (2) employment, and (3) income. Impacts on these factors in turn generate demands by the population (including the industries, government and general public) for facilities and services. Facilities can be considered as being the actual physical center of the activities, while services are the activities themselves. Changes in the factors of population, employment and income causes demands to be generated for facilities of the following major types: (1) housing, (2) highways-roads-streets, (3) utilities, (4) commercial business, (5) health, (6) recreation-leisure-culture, (7) criminal justice-judicial administration, (8) schools, and (9) public services. Services demands are expressed in terms of the following:

(1) shelter, (2) mobility, (3) infrastructure, (4) goods and services, (5) physical and mental health services, (6) leisure time and cultural activities, (7) law enforcement-criminal justice-judicial administration activities, (8) protection services, and (9) education.

The impacts fall into two major categories: primary and secondary. Primary impacts are those which relate to basic, necessity types of socioeconomic requirements of both existing and newly generated population influx. Secondary impacts relate to nonbasic requirements that are amenities which make for a higher level of quality of life and surroundings. In order to convert primary and secondary impacts into a facilities or services, an inventory is performed to determine the existing supply base.

Based on projected demands (i.e., in population, employment and income triggered by the development program) it is possible to relate existing supply to future demands. This relationship will give a description or quantification of any net deficiencies of future demands over current supply. From this, it is then possible to convert the net deficiency into a description of needs that are unmet over the development program time horizon under evaluation. These unmet needs must be related to the system's ability to supply facilities and services. Given net deficiencies in demands and equating this to the system's supply capability net deficiency between the gap in demand and supply can now be established.

The net deficiencies comprise the impacts against which mitigation measures can be developed. Based on mitigation measures that can be feasibly applied and their relative chance of success and/or failure one is left with those which will remain regardless of the effectiveness of the mitigating measures.

These net residual impacts remaining become the unavoidable adverse impacts, decision factors for consideration of alternatives to the proposed action, indicators to be utilized in performing trade-off analyses and optimization studies of short term gains versus long term losses or vice versa, and the impacts that ultimately become the commitment of resources to loss or destruction by the action as the result of implementation of an irreversible and irretrievable course of action.

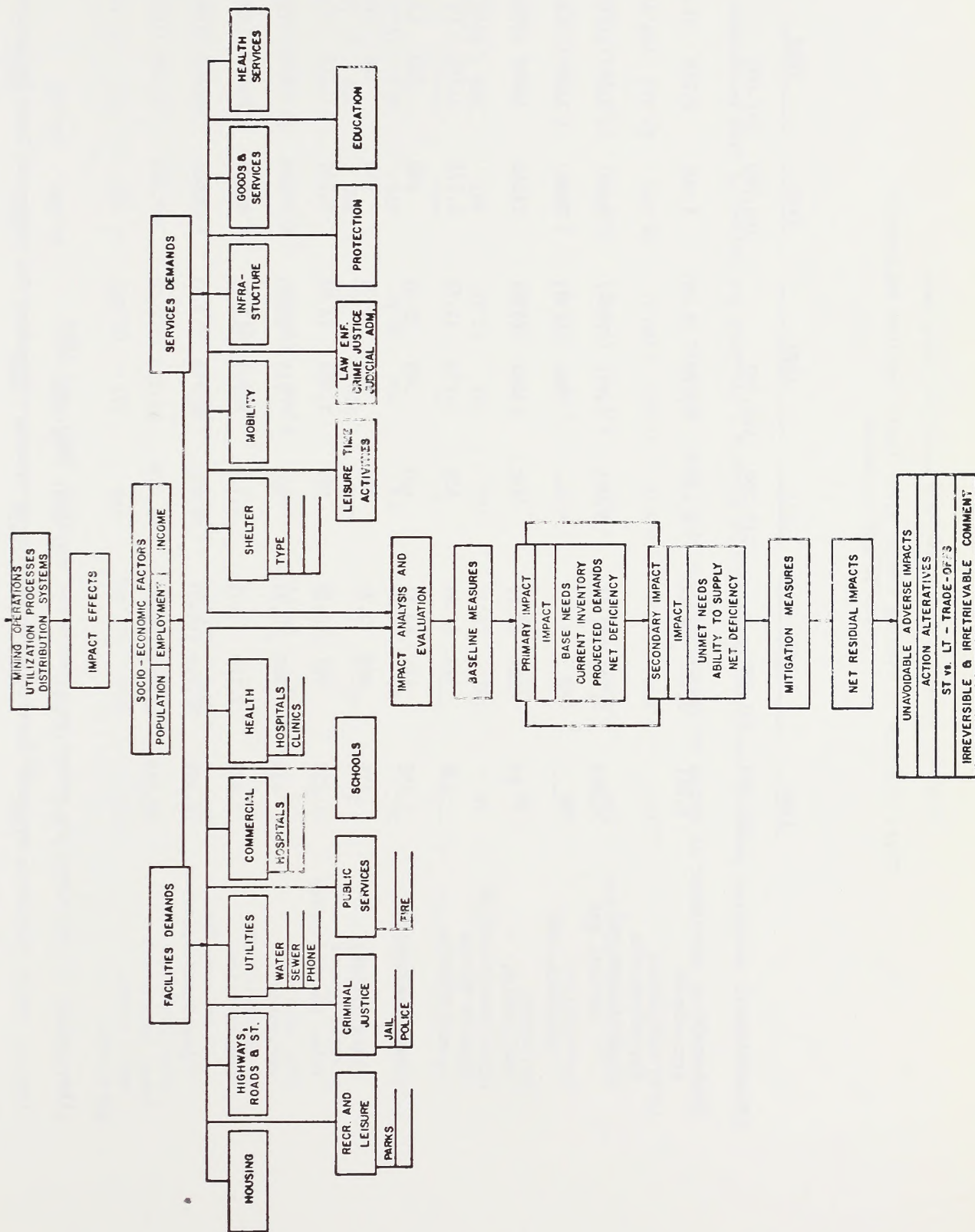


Table 45

Eight Counties of Wyoming Powder River Basin Combined Employment*
Historic and Projected

	1960	1970	1975	1980	1985	1990
Population	102,700	107,364	117,500	143,700	160,200	167,000
Employment						
Agriculture	4,861	3,784 (9.2%)	3,659	3,510 (6.0%)	3,400	3,319 (4.7%)
Petrochemicals						
Petroleum and						
Natural gas	4,964	5,135 (12.4)	5,006	4,895 (8.4)	5,147	5,143 (7.3)
Synthetic Gas	---	---	---	800 (1.4)	1,600	1,600 (2.3)
Coal Mining	95	224 (0.5)	310	1,682 (2.9)	2,542	3,022 (4.3)
Uranium Mining						
and Milling	136	572 (1.4)	850	1,472 (2.5)	1,772	1,744 (2.5)
Power Generation	193	221 (0.5)	425	350 (0.6)	550	753 (1.1)
Other Mining	126	269 (0.7)	331	407 (0.7)	472	520 (0.7)
Other Manufacturing	1,150	931 (2.3)	993	1,052 (1.8)	1,159	1,316 (1.9)
Railroads	518	305 (0.7)	305	519 (0.9)	608	656 (0.9)
Construction	3,677	3,196 (7.7)	4,729	6,827 (11.7)	6,506	6,762 (9.6)
Other Residentiaries	22,799	26,616 (64.5)	29,870	36,799 (63.1)	43,506	45,463 (64.7)
Total Employment	38,519	41,253 (99.9)	46,478	58,313 (100.0)	67,262	70,298 (100.0)

*Percentage of employment by sector in parentheses for 1970, 1980, and 1990.

Source: Water Resources Research Institute, University of Wyoming - Prepared for Bureau of Land Management

	1960	1970	1975	1980	1985	1990
Population	5,861	12,957	16,500	32,200	45,600	50,400
Employment	670	601	579	555	538	527
Agriculture			(12.5%)	(4.0%)		(2.4%)
Petrochemicals						
Petroleum and	224	1,364	1,332	1,302	1,376	1,375
Natural gas						(6.1)
Synthetic Gas	---	---	---	800	1,600	1,600
				(5.8)		(7.2)
Coal Mining	32	32	152	1,466	2,330	2,810
				(10.6)		(12.7)
Uranium Mining						
and Milling	2	---	---	150	250	250
				(1.1)		(1.1)
Power Generation	---	40	73	73	273	473
		(0.8)		(0.5)		(2.1)
Other Mining	---	---	---	---	---	---
Other Manufacturing	18	131	141	148	163	189
		(2.7)		(1.1)		(0.9)
Railroads	22	11	11	77	91	91
		(0.3)		(0.6)		(0.4)
Construction	189	268	1,604	3,107	2,604	2,773
		(5.6)		(22.4)		(12.5)
Other Residentiaries	1,120	2,356	3,041	6,174	10,839	12,079
		(49.1)		(44.6)		(54.5)
Total Employment	2,277	4,803	6,933	13,852	20,064	22,167
		(100.1)		(100.1)		(99.9)

Percentage of employment by sector in parentheses for 1970, 1980, and 1990.

Source: Water Resources Research Institute, University of Wyoming - Prepared for Bureau of Land Management.

Table 46

Campbell County - Historical and Projected Employment

Table 47

Converse County - Historical and Projected Employment*

	1960	1970	1975	1980	1985	1990
Population	6,366	5,938	9,900	13,200	14,900	15,200
Employment						
Agriculture	580	486 (22.4%)	469	450 (8.3%)	437	424 (6.6%)
Petrochemicals						
Petroleum and						
Natural Gas	177	204 (9.4)	199	186 (3.4)	206	205 (3.2)
Synthetic Gas	---	---	---	---	---	---
Coal Mining	17	39 (1.8)	68	194 (3.6)	190	190 (3.0)
Uranium Mining						
and Milling	30	71 (3.3)	350	572 (10.6)	772	772 (12.1)
Power Generation	25	---	188	188 (3.5)	188	188 (2.9)
Other Mining	---	---	---	---	20	---
Other Manufacturing	16	16 (0.7)	17	18 (0.3)	20	23 (0.4)
Railroads	25	6 (0.3)	22	181 (3.3)	256	304 (4.8)
Construction	192	225 (10.4)	318	434 (8.0)	502	511 (8.0)
Other Residentiaries	1,345	1,121 (51.7)	2,348	3,198 (59.0)	3,699	3,765 (59.0)
Total Employment	2,407	2,168 (100.0)	3,979	5,421 (100.0)	6,270	6,382 (100.0)

*Percentage of employment by sector in parentheses for 1970, 1980, and 1990.

Source: Water Resources Research Institute, University of Wyoming - Prepared for Bureau of Land Management.

	1960	1970	1975	1980	1985	1990
Population	4,691	4,535	4,500	4,500	4,600	4,600
Employment	637	461	447	428	414	405
Agriculture		(28.9%)		(25.5%)		(22.3%)
Petrochemicals						
Petroleum and	34	61	60	59	59	59
Natural Gas		(3.8)		(3.5)		(3.3)
Synthetic Gas	---	---	---	---	---	---
Coal Mining	---	---	---	---	---	---
Uranium Mining	37	---	---	---	---	---
and Milling						
Power Generation	---	---	---	---	---	---
Other Mining	71	130	160	197	228	252
		(8.1)		(11.7)		(13.9)
Other Manufacturing	88	60	64	68	75	85
		(3.8)		(4.0)		(4.7)
Railroads	8	8	6	6	6	6
		(0.5)		(0.4)		(0.3)
Construction	193	173	172	168	156	163
		(10.8)		(10.0)		(9.0)
Other Residentiaries	550	703	725	754	796	843
		(44.0)		(44.9)		(46.5)
Total Employment	1,618	1,596	1,634	1,680	1,734	1,813
		(99.9)		(100.0)		(100.0)

Percentage of employment by sector in parentheses for 1970, 1980, and 1990.

Source: Water Resources Research Institute, University of Wyoming - Prepared for Bureau of Land Management

Table 48

Crook County - Historical and Projected Employment

Table 49

Johnson County - Historical and Projected Employment*

	1960	1970	1975	1980	1985	1990
Population	5,475	5,587	5,200	7,500	7,400	7,400
Employment						
Agriculture	549	410	(18.6%) 398	382	(12.8%) 369	360 (12.1%)
Petrochemicals						
Petroleum and	146	101	(4.6) 98	96	(3.2) 96	96 (3.2)
Natural Gas	---	---	---	---	---	---
Synthetic Gas	---	---	---	---	---	---
Coal Mining	---	34	(1.5) ---	---	---	---
Uranium Mining	3	---	---	250	(8.4) 250	250 (8.4)
and Milling	---	---	---	---	---	---
Power Generation	---	---	---	---	---	---
Other Mining	2	19	(0.9) 23	29	(1.0) 33	36 (1.2)
Other Manufacturing	63	44	(2.0) 47	50	(1.7) 55	62 (2.1)
Railroads	---	---	---	---	---	---
Construction	235	294	(13.4) 210	290	(9.7) 268	268 (9.0)
Other Residentiaries	968	1,300	(59.0) 1,320	1,892	(63.3) 1,903	1,906 (64.0)
Total Employment	1,966	2,202	(100.0) 2,096	2,989	(100.0) 2,974	2,978 (100.0)

* Percentage of employment by sector in parentheses for 1970, 1980, and 1990

Source: Water Resources Research Institute, University of Wyoming - Prepared for Bureau of Land Management

	1960	1970	1975	1980	1985	1990
Population	49,623	51,264	54,200	59,000	60,400	61,800
Employment						
Agriculture	558	483 (2.4%)	467	448 (1.9)	434	423 (1.6)
Petrochemicals						
Petroleum and						
Natural Gas	3,745	2,906 (14.2)	2,839	2,774 (11.5)	2,932	2,930 (11.0)
Synthetic Gas	---	---	---	---	---	---
Coal Mining	---	---	---	---	---	---
Uranium Mining						
and Milling	64	501 (2.5)	500	500 (2.1)	500	472 (1.8)
Power Generation	78	106 (0.5)	106	31 (0.1)	31	34 (0.1)
Other Mining	10	17 (0.1)	21	26 (0.1)	30	33 (0.1)
Other Manufacturing	523	460 (2.3)	489	520 (2.2)	572	647 (2.4)
Railroads	255	145 (0.7)	130	114 (0.5)	114	114 (0.4)
Construction	1,845	1,545 (7.6)	1,734	2,134 (8.8)	2,279	2,327 (8.8)
Other residents	11,943	14,233 (69.8)	15,390	17,634 (72.9)	19,097	19,609 (73.7)
Total Employment	19,021	20,396 (100.1)	21,676	24,181 (100.1)	25,989	26,589 (99.9)

Percentage of employment by sector in parentheses for 1970, 1980, and 1990.

Source: Water Resources Research Institute, University of Wyoming - Prepared for Bureau of Land Management.

Table 50

Natrona County - Historical and Projected Employment

Table 51

Niobrara County - Historical and Projected Employment*

	1960	1970	1975	1980	1985	1990
Population	3,750	2,924	2,900	2,800	2,700	2,600
Employment						
Agriculture	539	313 (28.2%)	310	297 (27.9%)	288	282 (27.6)
Petrochemicals						
Petroleum and						
Natural Gas	117	48 (4.3)	47	47 (4.4)	47	47 (4.6)
Synthetic Gas	---	---	---	---	---	---
Coal Mining	---	---	---	---	---	---
Uranium Mining						
and Milling	---	---	---	---	---	---
Power Generation	---	---	---	---	---	---
Other Mining	---	---	---	---	---	---
Other Manufacturing	43	5 (0.4)	6	6 (0.6)	6	7 (0.7)
Railroads	---	7 (0.6)	6	6 (0.6)	6	6 (0.6)
Construction	72	73 (6.5)	71	69 (6.5)	67	66 (6.5)
Other Residentiaries	904	678 (60.1)	664	638 (60.0)	622	613 (60.0)
Total Employment	1,675	1,129 (100.1)	1,104	1,063 (100.0)	1,036	1,021 (100.0)

*Percentage of employment by sector in parentheses for 1970, 1980, and 1990.

Source: Water Resources Research Institute, University of Wyoming - Prepared for Bureau of Land Management.

	1960	1970	1975	1980	1985	1990
Population	18,989	17,852	18,200	18,200	18,300	18,500
Employment						
Agriculture	966	789 (12.0%)	767	735 (10.7%)	712	695 (10.0%)
Petrochemicals						
Petroleum and	12	57 (0.9)	54	54 (0.8)	54	54 (0.8)
Natural Gas						
Synthetic Gas	---	---	---	---	---	---
Coal Mining	46	119 (1.8)	90	22 (0.3)	22	22 (0.3)
Uranium Mining						
and Milling	---	---	---	---	---	---
Power Generation	30	30 (0.4)	30	30 (0.4)	30	30 (0.4)
Other Mining	3	3 (0.0)	4	5 (0.1)	5	5 (0.1)
Other Manufacturing	279	206 (3.1)	219	232 (3.4)	257	291 (4.2)
Railroads	198	110 (1.6)	116	121 (1.8)	121	121 (1.7)
Construction	684	472 (7.1)	478	479 (7.0)	480	486 (7.0)
Other Residentiaries	4,443	4,880 (73.1)	5,069	5,162 (75.5)	5,170	5,244 (75.5)
Total Employment	6,661	6,675 (100.0)	6,827	6,840 (100.0)	6,851	6,948 (100.0)
Percentage of employment by sector in parentheses for 1970, 1980, and 1990.						

Source: Water Resources Research Institute, University of Wyoming - Prepared for Bureau of Land Management.

Table 52

Sheridan County - Historical and Projected Employment

Table 53

Weston County - Historical and Projected Employment*

	1960	1970	1975	1980	1985	1990
Population	7,929	6,307	6,100	6,300	6,300	6,500
Employment						
Agriculture	362	227 (9.9%)	222	215 (9.4)	208	203 (8.5)
Petrochemicals						
Petroleum and Natural Gas	509	394 (17.3)	377	377 (16.5)	377	377 (15.7)
Synthetic Gas	---	---	---	---	---	---
Coal Mining	---	---	---	---	---	---
Uranium Mining and Milling	---	---	---	---	---	---
Power Generation	60	45 (2.0)	28	28 (1.2)	28	28 (1.2)
Other Mining	40	100 (4.4)	123	150 (6.6)	176	194 (8.1)
Other Manufacturing	120	9 (0.4)	10	10 (0.4)	11	12 (0.5)
Railroads	10	18 (0.8)	14	14 (0.6)	14	14 (0.6)
Construction	267	146 (6.4)	142	146 (6.4)	150	168 (7.0)
Other Residentiaries	1,526	1,345 (58.9)	1,313	1,347 (58.9)	1,380	1,404 (58.5)
Total Employment	2,894	2,284 (100.1)	2,229	2,287 (100.0)	2,344	2,400 (100.1)

*Percentage of employment by sector in parentheses for 1970, 1980, and 1990.

Source: Water Resources Research Institute, University of Wyoming - Prepared for Bureau of Land Management.

	Petrochemicals (Petroleum and Natural Gas)		Uranium Mining & Power		Other Mining	Other Manu- facturing	Railroads	Construction	Other Residentiaries	Total Employment
	Agriculture	Coal Mining	Uranium Mining & Milling	Generation						
Campbell	15.9	26.6	14.3	18.1	---	14.1	3.6	8.4	8.9	11.6
Converse	12.8	4.0	17.4	---	---	1.7	2.0	7.0	4.2	5.3
Crook	12.2	1.2	---	---	48.3	6.4	2.6	5.4	2.6	3.9
Johnson	10.8	2.0	15.2	---	7.1	4.7	---	9.2	4.9	5.3
Natrona	12.8	56.6	---	48.0	6.3	49.4	47.5	48.3	53.5	49.5
Niobrara	8.4	.9	---	---	---	.5	2.3	2.3	2.5	2.7
Sheridan	21.1	1.1	53.1	13.6	1.1	22.1	36.1	14.8	18.3	16.2
Weston	6.0	7.7	---	20.4	37.2	1.0	5.9	4.6	5.1	5.5
Total %	100.0%	100.1%	100.0%	100.1%	100.0%	99.9%	100.0%	100.0%	100.0%	100.0%

Table 54

Percentage of County Employment
by Sector Within 8 County Region
1970

Table 55

Percentage of County Employment
by Sector Within 8 County Region
1980

	Petrochemicals			Uranium		Other Mining	Other Manu- facturing	Railroads	Construction	Other Residen- tiaries	Total Employment
	Agriculture	Natural Gas	Synthetic Gas	Coal Mining	Mining & Milling						
Campbell	15.8%	26.6%	100%	87.2%	10.2%	20.9%	----	14.1%	45.5%	16.8%	23.8%
Converse	12.8	3.8	---	11.5	38.9	53.7	----	1.7	6.4	8.7	9.3
Crook	12.2	1.2	---	----	----	----	48.4%	6.5	2.5	2.0	2.9
Johnson	10.9	2.0	---	----	17.0	----	7.1	4.8	4.2	5.1	5.1
Natrona	12.8	56.7	---	----	34.0	8.9	6.4	49.4	31.3	47.9	41.5
Niobrara	8.5	1.0	---	----	----	----	----	0.6	1.0	1.7	1.8
Sheridan	20.9	1.1	---	1.3	----	8.6	1.2	22.1	7.0	14.0	11.7
Weston	6.1	7.7	---	----	----	8.0	36.9	1.0	2.1	3.7	3.9
Total %	100.0%	100.1%	100%	100.0%	100.1%	100.0%	100.0%	100.2%	100.0%	99.9%	100.0%

	Petrochemicals			Uranium		Power Generation	Other Mining	Other Manufacturing	Railroads	Construction	Other Residentaries	Total Employment
	Agriculture	Petroleum & Natural Gas	Synthetic Gas	Coal Mining	Uranium Mining & Milling							
Campbell	15.9%	26.7%	100%	93.0%	14.3%	62.8%	----	14.4%	13.9%	41.0%	26.6%	31.5%
Converse	12.8	4.0	---	6.3	44.3	25.0	----	1.7	46.3	7.6	8.3	9.1
Crook	12.2	1.1	---	----	----	----	48.5%	6.5	0.9	2.4	1.9	2.6
Johnson	10.8	1.9	---	----	14.3	----	6.9	4.7	----	4.0	4.2	4.2
Natrona	12.7	57.0	---	----	27.1	4.5	6.3	49.2	17.4	34.4	43.1	37.8
Niobrara	8.5	0.9	---	----	----	----	----	0.5	0.9	1.0	1.3	1.5
Sheridan	20.9	1.0	---	0.7	----	4.0	1.0	22.1	18.4	7.2	11.5	9.9
Weston	6.1	7.3	---	----	----	3.7	37.3	0.9	2.1	2.5	3.1	3.4
Total %	99.9%	99.9%	100%	100.0%	100.0%	100.0%	100.0%	100.0%	99.9%	100.1%	100.0%	100.0%

Table 56

Percentage of County Employment
by Sector Within 8 County Region
1990

Table 57

Approximate Cost Breakdown of an Average
Single-Family House, 1969

<u>Item</u>	Percentage of Cost	
	<u>NAHB</u>	<u>FHA</u>
Structure		
Basement and Masonry	9.6%	9.0
Envelope	15.6	15.7
Mechanical/Electrical Services	11.4	11.4
Balance of the Structure	10.7	11.3
Inside Work	7.3	7.1
Outside Work	2.1	1.7
Total Structure	56.7%	56.2%
Other Costs		
Land	22.8%	21.5%
Financing	6.5	7.5
Overhead and Profit	12.7	13.0
Other Expenditures	1.3	1.8
Total Other Cost	43.3%	43.8%
TOTAL COST OF UNITS	100.0%	100.0%

Source: "Housing Components", National Association of Home Builders, Dec. 1973.

Education Assumptions

Assumption: There will be 250 families per 1,000 population; each family unit consists of 3.5 persons.

The 1970 Census of Population provides the following information concerning family size and number of families per 1,000 population:

	<u>Family Size</u>	<u>Number of Families Per 1,000 Population</u>
State of Wyoming Average	3.53	254.8
Urban Population	3.49	252.7
Cities with 2,500-10,000 people	3.58	247.6
Cities with 10,000 or more people	3.43	255.7
Rural Population	3.61	258.0

From these figures above, 250 families per 1,000 population and an average family size of 3.5 persons was assumed for the purposes of this report.

Assumption: There will be 1.0 school age child per family unit or 250 school age children per 1,000 population.

	<u>State of Wyoming 1960</u>	<u>1970</u>	<u>Urban Population 1970</u>	<u>Rural Population 1970</u>
Number of school age children per family	0.98	1.04	1.003	1.09

Source: U.S. Bureau of Census, Census of Population, 1970.

Assumption: The number of school age children per family by school grade level are provided below:

<u>Type of School</u>	<u>Grade Levels</u>	<u>Number of school age Children Per Family Unit</u>
Elementary	K - 6	0.500
Junior High	7 - 9	0.250
Senior High	10 - 12	0.250

Table 58 provides the percentage of elementary, junior high and senior high school students in Powder River Basin School Districts. The above assumptions were made using regional averages.

Table 58
Percentage of Elementary, Jr. High, Sr. High Students in School
Districts of Powder River Basin
1972-1973

School Districts	Enrollment Fall	Elementary (K-6) Number	%	Jr. High (7-9) Number	%	Sr. High (10-12) Number	%
Gillette	3,117	1,704	54.7	790	25.3	623	20.0
Douglas	1,153	590	51.2	280	24.3	283	24.5
Glenrock	685	359	52.4	172	25.1	154	22.5
Sundance	1,239	659	53.2	299	24.1	281	22.7
Buffalo	1,271	591	46.5	344	27.1	336	26.4
Casper	13,505	6,617	49.0	3,437	25.4	3,451	25.5
Lusk	661	330	49.9	165	25.0	166	25.1
Ranchester	627	267	42.6	185	29.5	175	27.9
Sheridan	3,276	1,593	48.6	812	24.8	871	26.6
Clearmont	115	52	45.2	32	27.8	31	27.0
Newcastle	1,289	654	50.7	339	26.3	296	23.0
Upton	381	161	42.3	103	27.0	117	30.7
Region	27,319	13,577	49.7	6,958	25.5	6,784	24.8
State	84,831	43,841	51.7	21,275	25.1	19,715	23.2

Source: Wyoming State Department of Education, Division of Management Information Services, (1974).

District	1968	1969	1968-69 % Change	1970	1969-70 % Change	1971	1970-71 % Change	1972	1971-72 % Change	1973	1972-73 % Change
Campbell (1 Gillette)	2,489	2,979	19.7	3,281	10.1	2,968	-9.5	3,146	6.0	3,060	-2.7
Converse (1 Douglas) (2 Glenrock)	1,609	1,645	2.2	1,795	9.1	1,786	-0.5	1,846 (1,153) (693)	3.4	1,783 (1,104) (679)	-3.7 (-4.2) (-2.7)
Crook (1 Sundance)	1,251	1,269	1.4	1,283	1.1	1,237	-3.6	1,246	0.4	1,187	-4.7
Johnson (1 Buffalo)	1,414	1,363	-3.6	1,359	-0.3	1,287	-5.3	1,271	-1.2	1,209	-4.9
Natrona (Casper)	14,533	14,561	0.2	14,403	-1.1	14,118	-2.0	13,769	-2.5	13,181	-4.3
Niobrara (1 Lusk)	761	731	-3.9	698	-4.5	650	-6.9	665	2.3	616	-7.4
Sheridan (1 Ranchester) (2 Sheridan) (3 Clearmont)	4,193	4,144	-1.2	4,107	-0.9	4,103	-0.1	4,079 (627) (3,337) (115)	-0.6	4,074 (660) (3,291) (123)	-0.1 (5.3) (-1.4) (7.0)
Weston (1 Newcastle) (7 Upton)	1,941	1,871	-3.6	1,826	-2.4	1,741	-4.7	1,683 (1,302) (381)	-3.3	1,644 (1,266) (378)	-2.3 (-2.8) (-0.8)
State	86,013	86,440	0.5	86,886	0.5	86,430	-0.5	86,017	-0.5	85,391	-0.7

Source: Wyoming State Department of Education, Division of Management Information Services.

Table 59

Fall Enrollment in Powder River Basin School Districts
1968-1973

Table 60

Average Daily Membership*
(ADM)
1968-1973

District	1968-69	1969-70	Percent Change	1970-71	Percent Change	1971-72	Percent Change	1972-73	Percent Change
Campbell (1 Gillette)	2,561	3,021	18.0	3,116	3.1	2,799	-10.2	3,126	11.7
Converse (1 Douglas) (2 Glenrock)	1,613	1,631	1.1	1,816	11.3	1,792 (1,117) (675)	- 1.3 (-) (-)	1,771 (1,071) (700)	- 1.2 (-4.1) (3.7)
Crook (1 Sundance)	1,257	1,262	0.4	1,283	1.7	1,219	- 5.0	1,245	2.1
Johnson (1 Buffalo)	1,357	1,365	0.6	1,333	- 2.3	1,277	- 4.2	1,298	1.6
Natrona (1 Casper)	14,351	14,427	0.5	14,240	- 1.3	13,935	- 2.1	13,538	- 2.8
Niobrara (1 Lusk)	766	712	- 7.1	692	- 2.8	659	- 4.8	655	- 0.6
Sheridan (1 Rancheater) (2 Sheridan) (3 Clearmont)	4,241	4,093	- 3.5	4,144	1.3	4,128 (590) (3,407) (131)	- 0.4 (-) (-) (-)	4,051 (647) (3,286) (118)	- 1.9 (9.7) (-3.6) (-10.0)
Weston (1 Newcastle) (7 Upton)	1,934	1,855	- 4.1	1,797	- 3.1	1,724 (1,316) (408)	- 4.1 (-) (-)	1,698 (1,301) (397)	- 1.5 (-1.1) (-2.7)
State	85,228	85,424	0.2	86,086	0.8	85,331	- 0.9	85,002	- 0.4

*ADM means the total numbers of pupils present plus the total number of pupils absent, divided by the actual number of days the school was in session for the year. When a pupil is absent more than 10 consecutive days, all those days over 10 are deleted. A pupil who withdraws is dropped from membership the day after the last day he attended.

Source: Wyoming Public Schools General Fund Accounting, 1968 through 1973.

County (District)	Number of Schools	ADM	CRU**	ADM/ CRU	Assessed Valuation Per Pupil in ADM		Effective Expenditure Per Pupil in ADM
					Dollars	County Rank in State	
Campbell	20	3,126	159	19.7	48,228	1	1,219
Converse* (Douglas) (Glenrock)	21 (14) (7)	1,771 (1,071) (700)	111 (70) (41)	16.0 (15.3) (17.2)	38,679 (44,417) (29,876)	2	1,067 (1,107) (1,004)
Crook	16	1,245	88	14.1	22,897	10	1,139
Johnson	9	1,298	77	16.9	26,336	6	1,097
Natrona	37	13,538	724	18.7	10,984	21	865
Niobrara	10	655	46	14.1	25,241	7	1,132
Sheridan* (Ranchester) (Sheridan) (Clearmont)	23 (8) (12) (3)	4,051 (647) (3,286) (118)	242 (45) (184) (13)	16.7 (14.3) (17.8) (8.8)	10,968 (12,695) (9,788) (34,370)	22	908 (1,040) (851) (1,746)
Weston* (Newcastle) (Upton)	8 (5) (3)	1,698 (1,301) (397)	101 (73) (28)	16.8 (17.7) (14.2)	18,893 (17,686) (22,810)	14	1,017 (995) (1,092)
State	394	85,002	4,859	17.2	16,893		948

*County has more than one school district; school district figures are aggregated for the county; individual school district data are presented in parentheses above.

**Classroom Units

Source: Wyoming Public Schools General Fund Accounting 1972-73, 1, Wyoming State Department of Education, Division of Planning, Evaluation and Information Services.

Table 61

ADM/CRU, Assessed Valuation and Total Expenditure Per Pupil in ADM
Powder River Basin School Districts
1972-1973

Table 62

Public School Revenues by School District
in Powder River Basin Counties: 1972-1973

<u>District</u>	<u>Total Revenue Receipts</u>	<u>Sources of Revenues by Percent</u>			
		<u>District</u>	<u>County</u>	<u>State</u>	<u>Federal</u>
Campbell (1 Gillette)	\$ 5,457,573	58.5	36.9	4.5	0.09
Converse (1 Douglas)	1,465,323	54.8	38.7	6.4	0.12
(1 Glenrock)	812,977	52.4	40.2	7.0	0.40
Crook (1 Sundance)	1,653,021	41.8	26.1	32.0	0.13
Johnson (1 Buffalo)	1,530,389	53.0	31.7	14.7	0.64
Natrona (1 Casper)	12,148,074	30.3	18.8	49.1	1.74
Niobrara (1 Lusk)	865,107	43.4	28.1	28.4	0.11
Sheridan (1 Ranchester)	736,303	26.3	17.5	56.0	0.14
(2 Sheridan)	2,985,916	27.7	18.3	52.0	1.98
(3 Clearmont)	244,342	37.4	18.4	44.2	0
Weston (1 Newcastle)	1,324,691	45.0	26.1	28.7	0.20
(7 Upton)	513,560	44.4	26.4	29.2	0.08
Region	\$29,737,276	40.1	25.4	33.5	1.00
State	\$91,009,500	37.2	23.4	36.0	3.38

Source: Wyoming Public Schools General Fund Accounting, 1972-1973, State Department of Education, Division of Planning, Education and Information Services.

Type & Name of School	Grade Levels	Current Enrollment	Maximum Enrollment Capacity	% of Max. Enrollment Capacity	School Site Acreage	Structural Type
<u>CITY OF BUFFALO</u>						
ELEMENTARY:						
1. Buffalo	1-8*	608	650	93.5	5	Three permanent buildings
SENIOR HIGH:						
1. Buffalo	9-12	400	500	60.0	10	Permanent building
<u>RURAL SCHOOLS</u>						
ELEMENTARY:						
1. Barnum	1-4	5	40	12.5	--	Permanent, mason building
2. Billy Creek	1-4	10	40	25.0	--	Permanent building
3. Kaycee	1-8	100	180	55.6	--	Permanent building
4. Kearney	1-4	4	20	20.0	--	Permanent, wood frame building
5. Linch	1-6	35	125	28.0	--	Permanent, brick building and wood frame building
6. Sussex	1-6	7	50	14.0	--	Permanent brick building
SENIOR HIGH:						
1. Kaycee	9-12	55	100	55.0	15-20	New, permanent

*Kindergarten class will start in Fall 1974.

Source: Mr. Gerald Carroll, District Superintendent, Johnson County Unified School District, March, 1974.

Table 63

Johnson County Unified School District
1974

Table 64
Public Schools in Sheridan County
1974

<u>School District, Type & Name of School</u>	<u>Grade Levels</u>	<u>Current Enrollment</u>	<u>Maximum Enrollment Capacity</u>	<u>Percent of Maximum Capacity</u>
<u>Ranchester S.D. #1</u>				
1. Tongue River Elementary	K-6	150	180	83.3
2. Tongue River Jr.-Sr. High	7-12	210	210	100.0
3. Big Horn Elementary	K-6	129	159	81.1
4. Big Horn Jr.-Sr. High	7-12	163	180	90.6
5. Slack Rural	1-5	9	15	60.0
6. Big Goose Rural	-	Closed	-	-
<u>Sheridan S.D. #2</u>				
Elementary:				
1. Coffeen	K-6	397	-	-
2. Highland Park	K-6	381	-	-
3. Hill	Sp.Ed.	69	-	-
4. Linden	K-6	340	-	-
5. Taylor	K-6	161	-	-
6. Woodland Park	K-6	209	-	-
Junior High:				
1. Central	7-8	427	-	-
2. Woodland Park	7-8	75	-	-
Senior High:				
1. Sheridan	9-12	1,104	-	-
Rural Schools:				
1. Acme	1-6	33	-	-
2. Beckton	1-6	6	-	-
3. Story	1-6	46	-	-
Totals		3,248	3,600	90.2
<u>Clearmont S.D. #3</u>				
1. Clearmont Elementary	1-6	29	40	48.3
2. Arvada Elementary	1-6	14	40	35.0
3. Clearmont Jr.-Sr. High	7-12	75	200	37.5

Source: School Superintendents of Ranchester and Clearmont Unified School Districts and Assistant Superintendent of Sheridan Unified School District, March 1974.

Type & Name of School	Grade Levels	Current Enrollment	Maximum Enrollment Capacity	% of Max. Enrollment Capacity	School Site Acreage	Structural Type
<u>SUNDANCE</u>						
1. Elementary	K-6	251	330	76.1	12	Inadequate facilities
2. Junior High	7-8	100	130	76.9	--	Permanent building
3. Senior High	9-12	154	195	79.0	2-3	Permanent building
<u>MOORCROST</u>						
1. Elementary	K-6	187	220	85.0	20	Three schools located in
2. Junior High	7-8	67	110	60.9		a single, permanent
3. Senior High	9-12	100	140	71.4		education complex
<u>HULETT</u>						
1. Elementary	K-6	139	145	95.9	10	Three schools located in
2. Junior High	7-8	43	70	61.4		single, permanent
3. Senior High	9-12	86	105	81.9		education complex
<u>RURAL SCHOOLS</u>						
1. Baroid	1-6	19	40	47.5		Permanent, wood frame building
2. Brislawn	1-8	6	10	60.0		Trailer, school house
3. Bunny	1-8	4	18	22.2		Permanent building
4. Four Oaks	1-8	11	13	84.6		Mobile trailer
5. Homestake	1-8	3	30	10.0		Permanent building
6. Nebraska	1-8	5	10	50.0		Permanent building
7. Robinson	1-8	3	12	25.0		Permanent building

Source: Dr. Hugo Hendricks, District Superintendent, Crook County Unified School District, telephone interview, March 1974.

Table 65

Public Schools
Crook County Unified School District
1974

Table 66

Niobrara County Unified School District
1974

Type & Name of School	Grade Levels	Current Enrollment	Maximum Enrollment Capacity	% of Max. Enrollment Capacity	School Site Acreage	Structural Type
<u>LUSK</u>						
ELEMENTARY:						
1. Lusk	K-5	190	225	84.4	2	Permanent, brick and block bldg.
MIDDLE:						
1. Lusk Jr. High	6-8	145	150	96.7	2	Permanent building
SENIOR HIGH:						
1. Niobrara County	9-12	200	300	66.7	15-20	Permanent building
<u>RURAL SCHOOLS</u>						
1. Cheyenne River	1-8	6	25	24.0	-	2-room, wood frame building
2. Cow Creek	1-8	6	25	24.0	-	2-room, wood frame building
3. Fairview	1-8	2	25	8.0	-	2-room, wood frame building
4. Indian Creek	1-8	7	15	46.7	-	2-room, wood frame building
5. Lance Creek	1-8	14	125	11.2	-	8-room, wood frame building
6. Manville	1-8	32	100	32.0	-	2-storey, brick building
7. Seven Mile	1-8	2	25	8.0	-	2-room, wood frame building

Source: Mr. Lee Johnsonbaugh, District Superintendent, Niobrara County Unified School District, April 3, 1974.

Type & Name of School	Grade Levels	Current Enrollment	Maximum Enrollment Capacity	% of Max. Enrollment Capacity	School Site Acreage	Structural Type
<u>SCHOOL DISTRICT #1*</u>						
NEWCASTLE						
Elementary:						
1. Gertrude Burno	K-6	569	800	71.1	10	Permanent building
Junior High:						
1. Newcastle	7-8	206	250	82.4	5	Permanent building
Senior High:						
1. Newcastle	9-12	408	475	85.9	17	Permanent building
RURAL SCHOOLS						
1. Darlington	1-6	3	12	25.0	-	Permanent building
2. Osage	K-6	80	120	66.7	8	Permanent building
<u>SCHOOL DISTRICT #7**</u>						
UPTON						
1. Elementary	1-6	180	250	72.0	2-3	Permanent buildings complex
2. Junior High	7-8	75	95	80.0		houses the elementary and junior
3. Senior High	9-12	150	225	66.7		and senior high school

Source: * Mr. A. L. Albert, District Superintendent, Unified School District #1, March 1974, and
 ** Mr. Laverne Boal, District Superintendent, Unified School District #7, March, 1974.

Table 67

Public Schools in Weston County
 Newcastle Unified School District #1 and Upton Unified School District #7
 1974

Table 68

Public Schools in Casper, Natrona County Unified School District
1974

<u>Type and Name of School</u>	<u>Grade Levels</u>	<u>Current Enrollment</u>	<u>Schoolsite Acreage</u>
Elementary:			
1. Crest Hill	K-6	338	4.0
2. Evansville	K-6	242	2.15
3. Fairdale	K-6	381	5.05
4. Fort Casper	K-6	244	5.8
5. Garfield	K-6	230	4.1
6. Grant	K-6	350	2.06
7. Jefferson	K-6	283	1.6
8. Lincoln-Roosevelt	K-6	386	3.2
9. Manor Heights	K-6	332	6.8
10. McKinley	K-6	276	3.5
11. McKinley Annex	Sp.Ed.	51	-
12. Mills	K-6	289	2.2
13. Mountain View	K-6	286	3.85
14. Paradise Valley	K-6	336	8.0
15. Park	K-6	301	2.06
16. Pineview	K-6	385	8.47
17. Southridge	K-6	358	3.16
18. University Park	K-6	175	3.7
19. Westwood	K-6	363	3.3
20. Willard	K-6	359	2.5
21. Woods	Sp.Ed.	<u>51</u>	4.0
Sub-total		6,099	
Junior High:			
1. Cy	7-9	901	17.5
2. East	7-9	990	17.0
3. Morgan	7-9	1,457	4.4
Sub-total		3,348	
Senior High:			
1. Natrona County	10-12	1,847	11.3
2. Kelly Walsh	10-12	1,153	57.48
Sub-total		3,000	

Source: Mr. Gene R. Snider, Assistant Superintendent, Business Affairs, Natrona County Unified School District.

Table 69

Rural Schools and Learning Disabilities
Natrona County Unified School District
1974

<u>Type and Name of School</u>	<u>Grade Levels</u>	<u>Current Enrollment</u>	<u>School Site Acreage</u>
<u>MIDWEST</u>			
1. Elementary	K - 6	121	10.5
2. Jr.-Sr. High	7 - 12	<u>139</u>	10.5
Total		260	
<u>RURAL SCHOOLS</u>			
1. Alcova	1 - 7	19	-
2. Arminto	2 - 7	13	-
3. Bell Ranch	4 - 6	3	-
4. Forest Oil	2 - 5	4	-
5. Poison Spider	K - 6	153	-
6. Powder River	1 - 8	48	-
7. Red Creek	K - 1	3	-
8. Willow Creek	2 - 7	<u>5</u>	-
Total		248	
<u>CASPER LEARNING DISABILITIES</u>			
1. Fort Casper	-	25	-
2. Garfield	-	12	-
3. Grant	-	12	-
4. Jefferson	-	26	-
5. Lincoln Roosevelt	-	25	-
6. McKinley	-	37	-
7. Pineview	-	28	-
8. Willard	-	<u>12</u>	-
Total		177	

Source: Mr. Gene R. Snider, Asst. Superintendent, Natrona County Unified School District, April, 1974.

Table 70

Public School Enrollment Projections
Campbell County
1975-1990

	<u>1970</u>	<u>1975</u>	<u>% Change 1970-74</u>	<u>1980</u>	<u>% Change 1975-80</u>	<u>1985</u>	<u>% Change 1980-85</u>	<u>1990</u>	<u>% Change 1985-90</u>
Population	12,957	16,500	31.0	32,200	95.2	45,600	41.6	50,400	10.5
No. of Families per 1000 population	238	250	-----	250	-----	250	-----	250	-----
Total No. of Families	3,085	4,120	33.7	8,050	95.4	11,400	41.6	12,600	10.5
School Age Children per Family	0.97	1.0	-----	1.0	-----	1.0	-----	1.0	-----
School Age Children per 1000 Popu.	230	250	-----	250	-----	250	-----	250	-----
Total School Enrollment	2,979	4,120	38.2	8,050	95.4	11,400	41.6	12,600	10.5
Elementary Pupils (K-6) (% of total enrollment)	1,749 (58.7%)	2,060 (50.0%)*	17.8	4,030	95.6	5,700	41.4	6,300	10.5
Junior High Pupils (7-9) (% of total enrollment)	681 (22.9%)	1,030 (25.0%)*	51.2	2,010	95.1	2,850	41.8	3,150	10.5
Senior High Pupils (10-12) (% of total enrollment)	549 (18.4%)*	1,030 (25.0%)*	87.6	2,010	95.1	2,850	41.8	3,150	10.5

*Assumed percentages of enrollment apply from 1975 through 1990

	<u>1970</u>	<u>1975</u>	<u>% Change 1970-75</u>	<u>1980</u>	<u>% Change 1975-80</u>	<u>1985</u>	<u>% Change 1980-85</u>	<u>1990</u>	<u>% Change 1985-90</u>
Population	5,938	9,900	66.7	13,200	33.3	14,900	12.9	15,500	4.0
No. of Families per 1000 Population	266	250	----	250	----	250	----	250	----
Total No. of Families	1,582	2,475	56.4	3,300	33.3	3,725	12.9	3,875	4.0
School Age Children per Family	1.04	1.0	----	1.0	----	1.0	----	1.0	----
School Age Children per 1000 Popu.	277	250	----	250	----	250	----	250	----
Total School Enrollment	1,645	2,475	50.5	300	33.3	3,725	12.9	3,875	4.0
Elementary Pupils (K-6)	848	1,235	45.6	1,650	33.6	1,865	13.0	1,935	3.8
(% of total enrollment) (51.6%)		(50.0%)**							
Junior High Pupils (7-9)	435	620	42.5	825	33.1	930	12.7	970	4.3
(% of total enrollment) (26.4%)		(25.0%)**							
Senior High Pupils (10-12)	362	620	71.3	825	33.1	930	12.7	970	4.3
(% of total enrollment) (22.0%)		(25.0%)**							

*Includes Douglas Unified School District #1 and Glenrock Unified School District #2.

** Assumed percentages of enrollment apply from 1975 to 1990.

Table 71
Public School Enrollment Projections
Converse County*
1975-1990

Table 72
Public School Enrollment Projections
Johnson County
1975-1990

	1970	1975	% Change 1970-75	1980	% Change 1975-80	1985	% Change 1980-85	1990	% Change 1985-90
Population	5,587	5,200	-5.0	7,500	44.2	7,400	-1.3	7,400	0
No. of Families per 1000 Population	270	250	---	250	----	250	---	250	-
Total No. of Families	1,509	1,300	-13.9	1,875	44.2	1,850	-1.3	1,850	0
School Age Children per Family	0.9	1.0	----	1.0	----	1.0	---	1.0	-
School Age Children per 1000 Population	244	250	----	250	----	250	---	250	-
Total School Enrollment	1,363	1,300	-4.6	1,875	44.2	1,850	-1.3	1,850	0
Elementary Pupils (K-8) (% of total enrollment)	940 (69.0%)	865 (66.7%)*	-8.0	1,250	44.5	1,230	-1.6	1,230	0
Jr.-Sr. High Pupils (9-12) (% of total enrollment)	423 (31.0%)	435 (33.3%)*	2.8	625	43.7	620	-0.8	620	0

*Assumed percentages of enrollment apply from 1975 to 1990.

	<u>1970</u>	<u>1975</u>	<u>% Change 1970-75</u>	<u>1980</u>	<u>% Change 1975-80</u>	<u>1985</u>	<u>% Change 1980-85</u>	<u>1990</u>	<u>% Change 1985-90</u>
Population	17,852	18,200	1.9	18,200	0	18,300	0.5	18,500	1.1
No. of Families per 1000 Population	267	250	-----	250	-	250	---	250	---
Total No. of Families	4,766	4,550	-4.5	4,550	0	4,575	0.5	4,625	1.1
School Age Children per Family	0.87	1.0	-----	1.0	-	1.0	---	1.0	---
School Age Children per 1000 Population	232	250	-----	250	-	250	---	250	---
Total School Enrollment	4,144	4,550	9.8	4,550	0	4,575	0.5	4,625	1.1
Elementary Pupils (K-6) (% of total enrollment)	2,034 (49.1%)	2,270 (50%)**	11.6	2,270	0	2,285	0.7	2,315	1.3
Junior High Pupils (7-9) (% of total enrollment)	1,048 (25.3%)	1,140 (25%)**	8.8	1,140	0	1,145	0.4	1,155	0.9
Senior High Pupils (10-12) (% of total enrollment)	1,062 (25.6%)	1,140 (25%)**	7.3	1,140	0	1,145	0.4	1,155	0.9

*Includes Sheridan, Ranchester, and Clearmont Unified School Districts.

**Assumed percentages of enrollment apply from 1975 to 1990.

Table 73

Public School Enrollment Projections
Sheridan County*
1975-1990

Table 74
Public School Enrollment Projections
Crook County
1975-1990

	1970	1975	% Change 1970-75	1980	% Change 1975-80	1985	% Change 1980-85	1990	% Change 1985-90
Population	4,535	4,500	-0.8	4,500	0	4,600	2.2	4,600	0
No. of Families per 1000 Population	270	250	-----	250	-	250	---	250	-
Total No. of Families	1,224	1,125	-8.1	1,125	0	1,150	2.2	1,150	0
School Age Children per Family	1.04	1.0	-----	1.0	-	1.0	---	1.0	-
School Age Children per 1000 Population	280	250	-----	250	-	250	---	250	-
Total School Enrollment	1,269	1,125	-11.3	1,125	0	1,150	2.2	1,150	0
Elementary Pupils (K-6) (% of total enrollment)	689 (54.3%)	565 (50%)*	-18.0	565	0	575	1.8	575	0
Junior High Pupils (7-8) (% of total enrollment)	202 (15.9%)	185 (16.7%)*	-8.4	185	0	190	2.7	190	0
Senior High Pupils (9-12) (% of total enrollment)	378 (29.8%)	375 (33.3%)*	-0.8	375	0	385	2.7	385	0

*Assumed percentages of enrollment apply from 1975 to 1990.

	<u>1970</u>	<u>1975</u>	<u>% Change 1970-75</u>	<u>1980</u>	<u>% Change 1975-80</u>	<u>1985</u>	<u>% Change 1980-85</u>	<u>1990</u>	<u>% Change 1985-90</u>
Population	2,924	2,900	-0.8	2,800	-3.4	2,700	-3.6	2,600	-3.7
No. Of Families per 1000 Population	270	250	---	250	---	250	---	250	---
Total No. of Families	791	725	-8.3	700	-3.4	675	-3.6	650	-3.7
School Age Children per Family	0.92	1.0	---	1.0	---	1.0	---	1.0	---
School Age Children per 1000 Population	250	250	---	250	---	250	---	250	---
Total School Enrollment	731	725	-0.8	700	-3.4	675	-3.6	650	-3.7
Elementary Pupils (K-5) (% of total enrollment)	328 (44.9%)	305 (41.7%)*	-7.0	290	-4.9	280	-3.4	270	-3.6
Junior High Pupils (6-8) (% of total enrollment)	166 (22.7%)	180 (25%)*	8.4	175	-2.8	170	-2.9	165	-2.9
Senior High Pupils (9-12) (% of total enrollment)	237 (32.4%)	240 (33.3%)*	1.3	235	-2.1	225	-4.3	215	-4.3

*Assumed percentages of enrollment apply from 1975 to 1990.

Table 75

Public School Enrollment Projections
Nicholls County

Table 76

Public School Enrollment Projections
Natrona County
1975-1990

	1970	1975	% Change 1970-75	1980	% Change 1975-80	1985	% Change 1980-85	1990	% Change 1985-90
Population	51,264	54,200	5.7	59,000	8.9	60,400	2.4	61,800	2.3
No. of Families per 1000 Population	256	250	-----	250	-----	250	---	250	---
Total No. of Families	13,132	13,550	3.2	14,750	8.9	15,100	2.4	15,450	2.3
School Age Children per Family	1.1	1.0	-----	1.0	-----	1.0	---	1.0	---
School Age Children per 1000 Population	284	250	-----	250	-----	250	---	250	---
Total School Enrollment	14,561	13,550	-6.9	14,750	8.9	15,100	2.4	15,450	2.3
Elementary Pupils (K-6) (% of total enrollment)	7,814 (53.7%)	6,770 (50%)*	-13.4	7,370	8.9	7,500	2.4	7,730	2.4
Junior High Pupils (7-9) (% of total enrollment)	3,493 (24.4%)	3,290 (25%)*	-5.8	3,690	12.2	3,775	2.3	3,860	2.3
Senior High Pupils (10-12) (% of total enrollment)	3,254 (22.3%)	3,290 (25%)*	1.1	3,690	12.2	3,775	2.3	3,860	2.3

*Assumed percentages of enrollment apply from 1975 to 1990.

	<u>1970</u>	<u>1975</u>	<u>% Change 1970-75</u>	<u>1980</u>	<u>% Change 1975-80</u>	<u>1985</u>	<u>% Change 1980-85</u>	<u>1990</u>	<u>% Change 1985-90</u>
Population	6,307	6,100	-3.3	6,300	3.3	6,300	0	6,500	3.2
No. of Families per 1000 Population	256	250	-----	250	---	250	-	250	---
Total No. of Families	1,615	1,525	-5.6	1,575	3.3	1,575	0	1,625	3.2
School Age Children per Family	1.16	1.0	-----	1.0	---	1.0	-	1.0	---
School Age Children per 1000 Population	297	250	-----	250	---	250	-	250	---
Total School Enrollment	1,871	1,525	-18.5	1,575	3.3	1,575	0	1,625	3.2
Elementary Pupils (K-6) (% of total enrollment)	984 (52.6%)	760 (50%)**	-22.8	785	3.3	785	0	815	3.8
Junior High Pupils (7-8) (% of total enrollment)	319 (17.0%)	255 (16.7%)**	-20.1	265	3.9	265	0	270	1.9
Senior High Pupils (9-12) (% of total enrollment)	568 (30.4%)	510 (33.3%)**	-10.2	525	2.9	525	0	540	2.9

*Includes Newcastle Unified School District #1 and Upton Unified School District #7.

**Assumed percentages of enrollment apply from 1975 to 1990.

Table 77

Public School Enrollment Projections
Weston County*
1975-1990

	Actual		Projections		
	1969- 1970	1973- 1974	1980	1985	1990
TOTAL ENROLLMENT					
A. Projected Number of Pupils*	1,363	1,224	1,875	1,850	1,850
B. Maximum Capacity of Existing School Facilities*		<u>1,705</u> - 481	<u>1,705</u> + 170	<u>1,705</u> + 145	<u>1,705</u> + 145
C. Difference, A-B (+ over, - under capacity)		-28.2%	+10.0%	+ 8.5%	+ 8.5%
D. Percentage Over (+) or Under (-) Capacity, (A/B)-1					
ELEMENTARY ENROLLMENT (K-8)					
A. Projected Number of Pupils	940	769	1,250	1,230	1,230
B. Maximum Capacity of Existing School Facilities*		<u>1,105</u> - 336	<u>1,105</u> + 145	<u>1,105</u> + 125	<u>1,105</u> + 125
C. Difference, A-B (+ over, - under capacity)		-30.4%	+13.1%	+11.3%	+11.3%
D. Percentage Over (+) or Under (-) Capacity, (A/B)-1					
SENIOR HIGH ENROLLMENT (9-12)					
A. Projected Number of Pupils	423	455	625	620	620
B. Maximum Capacity of Existing School Facilities		<u>600</u> - 145	<u>600</u> + 25	<u>600</u> + 20	<u>600</u> + 20
C. Difference, A-B (+ over, - under capacity)		-24.2%	+ 4.2%	+ 3.3%	+ 3.3%
D. Percentage Over (+) or Under (-) Capacity, (A/B)-1					
FULL-TIME TEACHERS					
A. Existing Number of Teachers	84	74	74	74	74
B. Required Number of Teachers		<u>49</u>	<u>75</u>	<u>74</u>	<u>74</u>
C. Difference, A-B (+ Surplus/-deficiency)		+25	-1	0	0

* Includes figures for rural schools (grades 1-6)

** Based on students to teacher ratio of 25 to 1

	Actual			Projections		
	1969- 1970	1973- 1974		1980	1985	1990
Total Enrollment						
A. Projected Number of Pupils*	4,144	4,027		4,550	4,575	4,625
B. Maximum Capacity of Existing School Facilities*		<u>4,645</u>		<u>4,645</u>	<u>4,645</u>	<u>4,645</u>
C. Difference, A-B (+over, - under capacity)		- 618		- 95	- 70	- 20
D. Percentage Over (+) Under (-) Capacity, (A/B)-1		-13.3%		- 2.0%	- 1.5%	- 0.4%
ELEMENTARY ENROLLMENT (K-6)						
A. Projected Number of Pupils*	2,034	1,973		2,270	2,285	2,315
B. Maximum Capacity of Existing School Facilities*		<u>2,255</u>		<u>2,255</u>	<u>2,255</u>	<u>2,255</u>
C. Difference, A-B (+over, - under capacity)		- 282		+ 15	+ 30	+ 60
D. Percentage over (+) or under (-) capacity, (A/B)-1		-12.5%		+ 0.7%	+ 1.3%	+ 2.7%
JR.-SR. ENROLLMENT (7-12)						
A. Projected Number of Pupils*	2,110	2,054		2,280	2,290	2,310
B. Maximum Capacity of Existing School Facilities		<u>2,390</u>		<u>2,390</u>	<u>2,390</u>	<u>2,390</u>
C. Difference, A-B (+ over, - under capacity)		- 336		- 110	- 110	- 80
D. Percentage over (+) or under (-) capacity, (A/B)-1		-14.1%		- 4.6%	- 4.2%	- 3.3%
FULL-TIME TEACHERS						
A. Existing Number of Teachers	213	219		219	219	219
B. Required Number of Teachers**		<u>201</u>		<u>227</u>	<u>229</u>	<u>231</u>
C. Difference, A-B (+ surplus/-deficiency)		+ 18		- 8	- 10	- 12

* Includes figures for rural schools (grades 1-6) and special education school.

** Based on students to teacher ratio of 20 to 1.

Table 79

Sheridan County Unified School Districts #1, #2, and #3 Enrollment Projections, Impact on Enrollment Capacity, and Teacher Requirements

Table 80
Crook County Unified School District Enrollment Projections,
Impact on Enrollment Capacities and Teacher Requirements

	Actual		Projections		
	1969- 1970	1973- 1974	1980	1985	1990
TOTAL ENROLLMENT					
A. Projected Number of Pupils*	1,269	1,178	1,125	1,150	1,150
B. Maximum Capacity of Existing School Facilities*		1,578	1,578	1,578	1,578
C. Difference, A-B (+ over, - under capacity)		- 400	- 453	- 428	- 428
D. Percentage Over (+) or Under (-) capacity, (A/B)-1		-25.3%	-28.7%	-27.1%	-27.1%
ELEMENTARY ENROLLMENT (K-6)					
A. Projected Number of Pupils*	689	628	565	575	575
B. Maximum Capacity of Existing School Facilities*		828	828	828	828
C. Difference, A-B (+ over, - under capacity)		- 200	- 263	- 253	- 253
D. Percentage Over (+) or Under (-) capacity, (A/B)-1		-24.2%	-31.8%	-30.6%	-30.6%
JUNIOR HIGH ENROLLMENT (7-8)					
A. Projected Number of Pupils*	202	210	185	190	190
B. Maximum Capacity of Existing School Facilities		310	310	310	310
C. Difference, A-B (+ over, - under capacity)		-100	-125	-120	-120
D. Percentage Over (+) or Under (-) capacity, (A/B)-1		-32.3%	-40.3%	-38.7%	-38.7%
SENIOR HIGH ENROLLMENT (9-12)					
A. Projected Number of Pupils*	378	340	375	385	385
B. Maximum Capacity of Existing School Facilities		440	440	440	440
C. Difference, A-B (+ over, - under capacity)		-100	- 65	- 55	- 55
D. Percentage Over (+) or Under (-) capacity, (A/B)-1		-22.7%	-14.8%	-12.5%	-12.5%
FULL-TIME TEACHERS					
A. Existing Number of Teachers		84	84	84	84
B. Required Number of Teachers**		59	56	57	57
C. Difference, A-B (+ surplus/-deficiency)		+25	+28	+27	+27

* Includes figures for rural schools (grades 1-8).

** Based on students to teacher ratio of 20 to 1.

	Actual		Projections		
	1969-1970	1973-1974	1980	1985	1990
TOTAL ENROLLMENT					
A. Projected Number of Pupils*	731	604	700	675	650
B. Maximum Capacity of Existing School Facilities*		<u>1,015</u>	<u>1,015</u>	<u>1,015</u>	<u>1,015</u>
C. Difference, A-B (+ over, - under capacity)		- 411	- 315	- 340	- 365
D. Percentage Over (+) or Under (-) capacity, (A/B)-1		-40.5%	-31.0%	-33.5%	-36.0%
ELEMENTARY ENROLLMENT (K-5)					
A. Projected Number of Pupils*	328	259	290	280	270
B. Maximum Capacity of Existing School Facilities*		<u>565</u>	<u>565</u>	<u>565</u>	<u>565</u>
C. Difference, A-B (+ over, - under capacity)		- 306	- 275	- 285	- 295
D. Percentage Over (+) or Under (-) capacity, A/B-1		-54.2%	-48.7%	-50.4%	-52.2%
JUNIOR HIGH ENROLLMENT (6-8)					
A. Projected Number of Pupils*	166	144	175	170	165
B. Maximum Capacity of Existing School Facilities*		<u>150</u>	<u>150</u>	<u>150</u>	<u>150</u>
C. Difference, A-B (+ over, - under capacity)		- 6	+ 25	+ 20	+ 15
D. Percentage Over (+) or Under (-) capacity, (A/B)-1		- 3.3%	-16.7%	+13.3%	+10.0%
SENIOR HIGH ENROLLMENT (9-12)					
A. Projected Number of Pupils*	237	200	235	225	215
B. Maximum Capacity of Existing School Facilities		<u>300</u>	<u>300</u>	<u>300</u>	<u>300</u>
C. Difference, A-B (+ over, - under capacity)		- 100	- 65	- 75	- 85
D. Percentage Over (+) or Under (-) capacity, (A/B)-1		-33.3%	-21.7%	-25.0%	-28.3%
FULL-TIME TEACHERS					
A. Existing Number of Teachers	51	43	43	43	43
B. Required Number of Teachers**		<u>30</u>	<u>35</u>	<u>34</u>	<u>33</u>
C. Difference, A-B (+ surplus/-deficiency)		+ 13	+ 8	+ 9	+ 10

* Includes figures for rural schools (grades 1-8).

** Based on students to teacher ratio of 20 to 1.

Table 81
 Niobrara County Unified School District Enrollment Projections,
 Impact on Enrollment Capacities, and Teacher Requirements

Table 82
Weston County Unified School Districts #1 (Newcastle) and #7 (Upton) Enrollment Projections,
Impact on School Facilities, and teacher Requirement

	Actual		Projections			
	1969- 1970	1973- 1974	1980	1985	1990	
TOTAL ENROLLMENT						
A. Projected Number of Pupils*	1,871	1,671	1,575	1,575	1,625	
B. Maximum Capacity of Existing School Facilities**		<u>2,225</u>	<u>2,225</u>	<u>2,225</u>	<u>2,225</u>	
C. Difference, A-B (+ over, - under capacity)		- 554	- 650	- 650	- 600	
D. Percentage Over (+) or Under (-) capacity, (A/B)-1		-24.9%	-29.2%	-29.2%	-27.0%	
ELEMENTARY ENROLLMENT (K-6)						
A. Projected Number of Pupils*	984	832	785	785	815	
B. Maximum Capacity of Existing School Facilities**		<u>1,180</u>	<u>1,180</u>	<u>1,180</u>	<u>1,180</u>	
C. Difference, A-B (+ over, - under capacity)		- 348	- 395	- 395	- 395	
D. Percentage Over (+) or Under (-) capacity, (A/B)-1		-29.5%	-33.5%	-33.5%	-30.9%	
JUNIOR HIGH ENROLLMENT (7-8)						
A. Projected Number of Pupils*	319	281	265	265	270	
B. Maximum Capacity of Existing School Facilities		<u>345</u>	<u>345</u>	<u>345</u>	<u>345</u>	
C. Difference, A-B (+ over, - under capacity)		- 64	- 80	- 80	- 75	
D. Percentage Over (+) or Under (-) capacity (A/B)-1		-18.6%	-26.1%	-23.2%	-21.7%	
SENIOR HIGH ENROLLMENT (9-12)						
A. Projected Number of Pupils*	568	558	525	525	540	
B. Maximum Capacity of Existing School Facilities		<u>700</u>	<u>700</u>	<u>700</u>	<u>700</u>	
C. Difference, A-B (+ over, - under capacity)		-142	-175	-175	-160	
D. Percentage Over (+) or Under (-) capacity, (A/B)-1		-20.3%	-25.0%	-25.0%	-22.9%	
FULL-TIME TEACHERS						
A. Existing Number of Teachers	113	106	106	106	106	
B. Required Number of Teachers		<u>84</u>	<u>79</u>	<u>79</u>	<u>81</u>	
C. Difference, A-B (+ surplus/-deficiency)		+22	+27	+27	+25	

*Includes figures for rural schools (grades K-6).

**Based on students to teacher ratio of 20 to 1.

Table 83

Natrona County Unified School District Enrollment Projections,
Impact on School Enrollment Capacities and Teacher Requirements

	<u>1980</u>	<u>1985</u>	<u>1990</u>
TOTAL ENROLLMENT			
Projected Number of Pupils*	14,750	15,100	15,450
Number over (+), under (-) capacity	+750	+1,100	+1,450
Percent over or under capacity	+5.4%	+7.9%	+10.4%
ELEMENTARY ENROLLMENT (K-6)			
Projected Number of Pupils*	7,370	7,500	7,730
Number over (+), under (-) capacity	+270	+500	+630
Percent over or under capacity	+3.8%	+5.6%	+8.9%
JUNIOR HIGH ENROLLMENT (7-9)			
Projected Number of Pupils	3,690	3,775	3,860
Number over (+), under (-) capacity	+130	+215	+300
Percent over or under capacity	+3.6%	+6.0%	+8.4%
SENIOR HIGH ENROLLMENT (10-12)			
Projected Number of Pupils	3,690	3,775	3,860
Number over (+), under (-) capacity	+315	+500	+585
Percent over or under capacity	+12.7%	+15.3%	+17.9%
FULL-TIME TEACHERS			
Projected Number Required**	590	604	618
Deficit***	+24	+10	-4

*Includes figures for rural schools (grades K-8).

**Based on students to teacher ratio of 25 to 1.

***Based on Fall 1973 levels (FTE Classroom Teachers).

Table 84

Gillette Police Department
Campbell County
Projections for Full-time Manpower, Office Facilities
and Patrol Vehicles

	<u>1973</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>
POPULATION** OF GILLETTE	7,194	17,870	25,310	27,970
MANPOWER: FULL-TIME POLICEMEN				
Projected Number Required***	16	30	43	47
Deficit###	0	-14	-27	-31
OFFICE FACILITIES IN SQUARE FEET				
Projected Area Required#	3,500	3,040	4,300	4,750
Deficit###	0	0	-800	-1,250
PATROL VEHICLES				
Projected Number Required##	5	10	14	16
Deficit###	0	-5	-9	-11

*1973 figures represent existing levels in manpower, office space, patrol vehicles, and associated deficits.

**Derived by multiplying 1980-1990 population projections for Campbell County by 55.5 percent, the county's urban population level in 1970.

***Assume 1.7 full-time policemen per 1,000 population for cities with 10,000 or more people (FBI, Crime in the U.S. - 1972, Uniform Crime Reports)

#Assume 100 square feet per full-time policeman (Wirth-Berger Associates, draft, Powder River Basin Capital Facilities Study, 1974).

##Assume a minimum of one patrol vehicle per three full-time policemen (Wirth-Berger Associates).

###Deficits equal projected demands minus existing (1973) levels.

Table 85

Douglas Police Department
Converse County
Projections for Full-time Manpower, Office Facilities
and Patrol Vehicles

	<u>1973*</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>
POPULATION** OF DOUGLAS	2,677	5,955	6,720	6,990
MANPOWER: FULL-TIME POLICEMEN				
Projected Number Required***	7	12	13	14
Deficit###	0	-5	-6	-7
OFFICE FACILITIES IN SQUARE FEET				
Projected Area Required#	1,000	1,200	1,300	1,400
Deficit###	0	-200	-300	-400
PATROL VEHICLES				
Projected Number Required##	3	4	4	5
Deficit###	0	-1	-1	-2

*1973 figures represent existing levels in manpower, office space, patrol vehicles, and associated deficits.

**Derived by multiplying 1980-1990 population projections for Converse County by 45.1 percent, the county's urban population level in 1970.

*** Assume 2.0 full-time policemen per 1,000 population for cities with less than 10,000 people (FBI, Crime in the U.S. - 1972, Uniform Crime Reports).

#Assume 100 square feet per full-time policeman (Wirth-Berger Associates, draft, Powder River Basin Capital Facilities Study, 1974).

##Assume a minimum of one patrol vehicle per three full-time policemen (Wirth-Berger Associates).

###Deficits equal projected demand minus existing (1973) levels.

Table 86

Glenrock Police Department
Converse County
Projections for Full-Time Manpower, Office Facilities
and Patrol Vehicles

	<u>1973*</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>
POPULATION** OF GLENROCK	1,515	3,370	3,800	3.950
MANPOWER: FULL-TIME POLICEMEN				
Projected Number Required***	5	7	8	8
Deficit###	0	-2	-3	-3
OFFICE FACILITIES IN SQUARE FEET				
Projected Area Required#	400	700	800	800
Deficit###	-100	-300	-400	-400
PATROL VEHICLES				
Projected Number Required##	1	2	3	3
Deficit###	-1	-1	-2	-2

*1973 figures represent existing levels in manpower, office space, patrol vehicles, and associated deficits.

**Derived by multiplying 1980-1990 population projections for Converse County by 25.5%, the town's percentage of county population in 1970.

***Assume 2.0 full-time policemen per 1,000 population for cities with less than 10,000 people. (FBI, Crime in the U.S. - 1972, Uniform Crime Reports).

#Assume 100 square feet per full-time policeman (Wirth-Berger Associates, draft, Powder River Basin Capital Facilities Study, 1974).

##Assume a minimum of one patrol vehicle per three full-time policemen (Wirth-Berger Associates).

###Deficits equal projected demand minus existing (1973) levels.

Table 87

Buffalo Police Department
Johnson County
Projections for Full-time Manpower, Office Facilities and
Patrol Vehicles

	<u>1973*</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>
POPULATION** OF BUFFALO	3,394	4,555	4,490	4,490
MANPOWER: FULL-TIME POLICEMEN				
Projected Number Required***	6	9	9	9
Deficit###	-1	-3	-3	-3
OFFICE FACILITIES IN SQUARE FEET				
Projected Area Required#	130	900	900	900
Deficit###	-770	-770	-770	-770
PATROL VEHICLES				
Projected Number Required##	2	3	3	3
Deficit###	0	-1	-1	-1

*1973 figures represent existing levels in manpower, office space, patrol vehicles, and associated deficits.

**Derived by multiplying 1980-1990 population projections for Johnson County by 60.7 percent, the county's urban population in 1970.

***Assume 2.0 full-time policemen per 1,000 population for cities with less than 10,000 people (FBI, Crime in the U.S. - 1972, Uniform Crime Reports).

#Assume 100 square feet per full-time policeman (Wirth-Berger Associates, draft, Powder River Basin Capital Facilities Study, 1974).

##Assume a minimum of one patrol vehicle per three full-time policemen (Wirth-Berger Associates).

###Deficits equal projected demand minus existing (1973) levels.

Table 88

Sheridan Police Department
 Sheridan County
 Projections for Full-Time Manpower, Office Facilities
 and Patrol Vehicles

	<u>1973*</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>
POPULATION** OF SHERIDAN	10,856	11,065	11,125	11,250
MANPOWER: FULL-TIME POLICEMEN				
Projected Number Required***	17	19	19	19
Deficit###	-1	-2	-2	-2
OFFICE FACILITIES IN SQUARE FEET				
Projected Area Required#	8,640	1,900	1,900	1,900
Deficit###	0	0	0	0
PATROL VEHICLES				
Projected Number Required##	5	6	6	6
Deficit###	0	-1	-1	-1

*1973 figures represent existing levels in manpower, office space, patrol vehicles, and associated deficits.

**Derived by multiplying 1980-1990 population projections for Sheridan County by 60.8 percent, the county's urban population in 1970.

***Assume 1.7 full-time policemen per 1,000 population for cities with 10,000 or more people. (FBI, Crime in the U.S. - 1972, Uniform Crime Reports).

#Assume 100 square feet per full-time policeman (Wirth-Berger Associates, draft, Powder River Basin Capital Facilities Study, 1974).

##Assume a minimum of one patrol vehicle per three full-time policemen (Wirth-Berger Associates).

###Deficits equal projected demand minus existing (1973) levels.

Table 89

Casper Police Department
Natrona County
Projections for Full-Time Manpower, Office Facilities
and Patrol Vehicles

	<u>1973*</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>
POPULATION** OF CASPER	39,361	45,315	46,390	47,465
MANPOWER: FULL-TIME POLICEMEN				
Projected Number Required***	56	77	79	81
Deficit####	-11	-21	-23	-25
OFFICE FACILITIES IN SQUARE FEET				
Projected Area Required#	3,245	7,700	7,900	8,000
Deficit####	-3,455	0****	0	0
PATROL VEHICLES				
Projected Number Required##	16	26	26	27
Deficit####	-3	-10	-10	-10

*1973 figures represent existing levels in manpower, office space, patrol vehicles, and associated deficits.

**Derived by multiplying 1980-1990 population projections for Natrona County by 76.8 percent, the county's urban population level in 1970.

***Assume 1.7 full-time policemen per 1,000 population for cities with 10,000 or more people (FBI, Crime in the U.S. -1972, Uniform Crime Reports).

#Assume 100 square feet per full-time policeman (Wirth-Berger Associates, draft, Powder River Basin Capital Facilities Study, 1974).

##Assume a minimum of one patrol vehicle per three full-time policemen (Wirth-Berger Associates).

###Deficits equal projected demand minus existing (1973) levels.

****By 1980, department will have new facilities with 12,000 square feet.

Table 90

Mills Police Department
Natrona County
Projections for Full-Time Manpower, Office Facilities
and Patrol Vehicles

	<u>1973*</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>
POPULATION** OF MILLS	1,724	2,005	2,005	2,100
MANPOWER: FULL-TIME POLICEMEN				
Projected Number Required***	2	4	4	4
Deficit###	-1	-2	-2	-2
OFFICE FACILITIES IN SQUARE FEET				
Projected Area Required#	100	400	400	400
Deficit###	-100	-300	-300	-300
PATROL VEHICLES				
Projected Number Required##	1	1	1	1
Deficit###	0	0	0	0

*1973 figures represent existing levels in manpower, office space, patrol vehicles, and associated deficits.

**Derived by multiplying 1980-1990 population projections for Natrona County by 3.4 percent, the town's percentage of county population in 1970.

***Assume 2.0 full-time policemen per 1,000 population for cities with less than 10,000 people (FBI, Crime in the U.S. - 1972, Uniform Crime Reports).

#Assume 100 square feet per full-time policeman (Wirth-Berger Associates, draft, Powder River Basin Capital Facilities Study, 1974).

##Assume a minimum of one patrol vehicle per three full-time policemen (Wirth-Berger Associates).

###Deficits equal projected demand minus existing (1973) levels.

Table 91

Newcastle Police Department
Weston County
Projections for Full-Time Manpower, Office Facilities
and Patrol Vehicles

	<u>1973*</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>
POPULATION** OF NEWCASTLE	3,432	3,430	3,430	3,535
MANPOWER: FULL-TIME POLICEMEN				
Projected Number Required***	9	7	7	7
Deficit#	0	0	0	0
OFFICE FACILITIES IN SQUARE FEET				
Projected Area Required##	500	700	700	700
Deficit#	-400	-200	-200	-200
PATROL VEHICLES				
Projected Number Required###	2	2	2	2
Deficit#	-1	0	0	0

*1973 figures represent existing levels in manpower, office space, patrol vehicles, and associated deficits.

**Derived by multiplying 1980-1990 population projection for Weston County by 54.4 percent, the county's urban population level in 1970.

***Assume 2.0 full-time policemen per 1,000 population for cities with less than 10,000 people (FBI, Crime in the U.S. - 1972, Uniform Crime Reports).

#Deficits equal projected demand minus existing (1973) levels.

##Assume 100 square feet per full-time policeman (Wirth-Berger Associates, draft, Powder River Basin Capital Facilities Study, 1974).

###Assume a minimum of one patrol vehicle per three full-time policemen (Wirth-Berger Associates).

Table 92

Sundance Police Department
Crook County
Projections for Full-Time Manpower, Office Facilities
and Patrol Vehicles

	<u>1973*</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>
POPULATION** OF SUNDANCE	1,056	1,050	1,070	1,070
MANPOWER: FULL-TIME POLICEMEN				
Projected Number Required***	1	2	2	2
Deficit#	-1	-1	-1	-1
OFFICE FACILITIES IN SQUARE FEET				
Projected Area Required##	400	200	200	200
Deficit#	0	0	0	0
PATROL VEHICLES				
Projected Number Required##	1	1	1	1
Deficit#	0	0	0	0

*1973 figures represent existing levels in manpower, office space, patrol vehicles, and associated deficits.

**Derived by multiplying 1980-1990 population projections for Crook County by 23.2 percent, the town's percentage of county population in 1970.

***Assume 2.0 full-time policemen per 1,000 population for cities with less than 10,000 people (FBI, Crime in the U.S. - 1972, Uniform Crime Reports).

#Deficits equal projected demand minus existing (1973) levels.

##Assume 100 square feet per full-time policeman (Wirth-Berger Associates, draft, Powder River Basin Capital Facilities Study, 1974).

###Assume a minimum of one patrol vehicle per three full-time policemen (Wirth-Berger Associates).

Table 93

Lusk Police Department
Niobrara County
Projections for Full-Time Manpower, Office Facilities
and Patrol Vehicles

	<u>1973*</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>
POPULATION** OF LUSK	1,495	1,430	1,380	1,330
MANPOWER: FULL-TIME POLICEMEN				
Projected Number Required***	4	3	3	3
Deficit#	0	0	0	0
OFFICE FACILITIES IN SQUARE FEET				
Projected Area Required##	400	300	300	300
Deficit#	0	0	0	0
PATROL VEHICLES				
Projected Number Required###	1	1	1	1
Deficit#	0	0	0	0

*1973 figures represent existing levels in manpower, office space, patrol vehicles, and associated deficits.

**Derived by multiplying 1980-1990 population projections for Niobrara County by 51.1 percent, the town's percentage of county population in 1970.

***Assume 2.0 full-time policemen per 1,000 population for cities with less than 1,000 people (FBI, Crime in the U.S. - 1972, Uniform Crime Reports).

#Deficits equal projected demand minus existing (1973) levels.

##Assume 100 square feet per full-time policeman (Wirth-Berger Associates, draft, Powder River Basin Capital Facilities Study, 1974).

###Assume a minimum of one patrol vehicle per three full-time policemen (Wirth-Berger Associates).

Table 94

Required Fire Flow

<u>Population</u>	<u>Gallons Per Minute</u>
1,000	1,000
1,500	1,250
2,000	1,500
3,000	1,750
4,000	2,000
5,000	2,250
6,000	2,500
10,000	3,000
13,000	3,500
33,000	5,500
40,000	6,000
55,000	7,000

*Note: Fire flow may be increased or decreased in accordance with structural conditions and degree of congestion.

Source: Standard schedule for Grading Cities and Towns, U.S. National Board of Fire Underwriters, N.Y., Chicago, San Francisco.

Fire Flow	First Due*				First Alarm**				Maximum Multiple Alarm			
	Eng.		Lad.		Eng.		Lad.		Eng.		Lad.	
gpm	No.	Mi.	No.	Mi.	No.	Mi.	No.	Mi.	No.	Mi.	No.	Mi.
less than 2,000	1	1½#	***1	#2	#2	4	***1	#2	#2	4	***1	#2
2,000	1	1½#	***1	#2	#2	2½	***1	#2	2	2½	***	2,500
3,000	1	1½	***1	2	2	2½	***1	2	3	3	***1	2
3,500	1	1½	***1	2	2	2½	***1	2	3	3	***1	2
4,000	1	1½	1	2	2	2½	1	2	4	3½	1	2
4,500	1	1½	1	2	2	2½	1	2	4	3½	1	2
5,000	1	1	1	1½	2	2	1	1½	5	3½	2	2½
5,500	1	1	1	1½	2	2	1	1½	5	3½	2	2½
6,000	1	1	1	1½	2	2	1	1½	6	4	2	2½
6,500	1	1	1	1½	2	2	1	1½	6	4	2	2½
7,000	1	1	1	1½	2	1½	1	1½	7	4	3	3½
7,500	1	1	1	1½	2	1½	1	1½	8	4½	3	3½
8,000	1	1	1	1½	2	1½	1	1½	9	4½	3	3½
8,500	1	1	1	1½	2	1½	1	1½	9	4½	3	3½
9,000	1	¾	1	1	3	1½	2	2	10	4½	4	4
10,000	1	¾	1	1	3	1½	2	2	12	5	5	4½
11,000	1	¾	1	1	3	1½	2	2	14	5	6	5
12,000	1	¾	1	1	3	1½	2	2	15	5	7	5

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*"First due" refers to the equipment needed to be within range to respond to a fire immediately.
 **"First Alarm" refers to "first due" equipment plus additional equipment needed to be able to respond should fire prove to be too large to be handled by "first due" equipment.
 ***Where there are less than 5 buildings of a height corresponding to 3 or more stories, a ladder company may not be needed to provide ladder service.
 #May be increased to 2 miles for residential districts of 1- and 2-family dwellings, and to 4 miles where such dwellings have an average separation of 100 feet or more.
 ##May be increased to 3 miles for residential districts of 1- and 2-family dwellings, and to 4 miles where such dwellings have an average separation of 100 feet or more.
 ###Same as first due where only one engine company is required in the municipality.

Table 95
 Number of Engine and Ladder Companies Needed within Travel Distance of Required Fire Flow

APPENDIX D

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Forest Service Objectives and Procedures Relative to Issuing Railroad Rights-of-Way Easements on the Thunder Basin National Grasslands

The Bankhead-Jones Farm Tenant Act of July 22, 1937 provides the means by which the Forest Service objects can be met:

1. Preplan all railroad rights-of-way, affected adjacent areas and offsite supporting facilities based upon:
 - a. Adequate resource and other pertinent data provided by the railroad or mining companies to enable a right-of-way plan (including reclamation) to be prepared and approved prior to the time construction actually commences; and
 - b. Selection of the most appropriate right-of-way and reclamation system to:
 - (1) Minimize environmental disturbance, and
 - (2) Provide for maximum transportation needs in a single or sequential preplanned operation.
2. In right-of-way construction and reclamation, the operation will seek to achieve the most beneficial use of the National Grasslands in harmony with adjacent public and private lands.

The right-of-way plan (including reclamation) should be a flexible tool capable of periodic review to incorporate advances in technology. The Forest Service will determine whether or not it will approve the right-of-way plan (including reclamation) and issue the easement, or if not, what modifications it deems necessary prior to such action.

The Forest Service will require an operating plan which will more specifically indicate how Forest Service requirements will be met. Such a plan will be modified when changes in operation are anticipated and submitted to the

Forest Supervisor for approval. The Forest Service will periodically review the right-of-way operations as they affect surface values against the easement requirements, operating plan, and the approved right-of-way plan (including reclamation) prepared for that operation.

Ecosystem Description

The following detailed ecosystem information can be related to vegetation and soils for Atlantic Richfield and Kerr-McGee leases by map (individual lease) and ecosystem number.

Ecosystem No. 1: Western wheatgrass-foxtail barley grassland on playas with deep clayey soils.

I. General Description

This ecosystem is found on the playas which are present on nearly level uplands. Soils are deep, clayey, and subject to periodic inundation from runoff but water does not remain surfaced for dry periods. The general appearance of the vegetation is a sparsely vegetated grassland dominated by western wheatgrass (Agropyron smithii). Shrubs or trees do not occur. When not inundated or muddy, this ecosystem can provide grazing for both domestic livestock and wildlife. It can provide water for animals when inundated and may be habitat for amphibians and aquatic birds.

II. Land System

A. Province - Great Plains

B. Section - Missouri Plateau (unglaciaded)

C. Subsection - Powder River Basin

D. Landtype Association - Slightly dissected interstream uplands

E. Landtype - Playas

1. Geology - Fluviolacustrine sediments eroded from surrounding uplands
2. Physiography - Playas are shallow, intermittent, lakes occurring as slightly concave depressions forming small closed basins on upland landforms.
 - a. Elevation range - 4,600 to 5,000 feet m.s.l.
 - b. Slope angles - 0 to 3 percent.
 - c. Dissection - None.
 - d. Drainage pattern - Undeveloped.
3. Soils - The dominant soil is the McKenzie series. This series consists primarily of gray or dark gray clay materials which have eroded from upland soils. McKenzie clay varies in stage of development as carbonate bearing layers which may occur a few inches to several feet below the surface. The surface layer is 2-5 inches thick and has clay to sandy loam texture. Approximately 85-90% of the soil surface is exposed bare soil. Rocks or erosion pavement is absent. The substratum is dominantly a gray clay and may be more than 60 inches deep. Carbonate content is variable, but usually increases with depth. Internal drainage is very slow. Soil reaction is normally strongly to very strongly alkaline. Saline and sodic salts are present in some locations.
 - a. Depth range - 40 inches.

- b. Texture - Clayey.
 - c. Mineralogy - Montmorillontic
 - d. Series and classification
 - (1) McKenzie: Typic Haplaquept - fine, montmorillontic, calcareous, mesic.
4. Climate: (General pattern for the Powder River Coal Basin)
- a. Precipitation - 10 to 12 inch precipitation zone.
 - b. Temperature (Average and range)
 - (1) Spring: 43°F. (-22 to 95°F.)
 - (2) Summer: 68°F. (29 to 110°F.)
 - (3) Fall: 47°F. (-20 to 100°F.)
 - (4) Winter: 24°F. (-40 to 69°F.)
 - c. Growing season - 119 to 141 days.
 - d. Sunshine - 60 to 70 percent possible.
 - e. Wind
 - (1) Direction - west to northwest.
 - (2) Velocity - 6 to 8 mph; 30 to 40 mph frequently; maximum March to May.
5. Hydrology - Runoff water is ponded in the playas for short periods of time following snowmelt and rainstorms. Much of the ponded water is lost to evaporation and deep percolation. A fluctuating water table normally is present in deeper substrata below the dry surface.

III. Vegetation System

- A. Formation - Grassland
- B. Region - Central and Eastern Grassland
- C. Series - Western wheatgrass
- D. Community Type - Western wheatgrass-foxtail barley grassland. The western wheatgrass-foxtail barley grassland community type is almost exclusively associated with the playa landtype. Western wheatgrass provides about 50 percent of the species composition; foxtail barley 45 percent; thus the vegetation is basically bi-specific. Ground cover of vascular vegetation averages less than 10 percent, and the general appearance is a very sparsely vegetated grassland. Litter cover is also very low about 5 percent, and the cryptogam layer is absent. Consequently, most of the ground surface is bare soil. Best estimates of total herbage production is 450 lb/acre of air dry material.

Ecosystem No. 1a: Western wheatgrass-slender spikerush grassland on playas with deep clayey soils.

I. General Description

This grassland ecosystem is found on small playas which are present on

nearly level uplands. Soils are deep, clayey and subject to periodic inundation from runoff. The period of high water appears to be longer than in the western wheatgrass-foxtail barley ecosystem (No. 1) and the vegetative cover is greater, but the general appearance is still a grassland devoid of woody vegetation. When dry, the ecosystem can be grazed by livestock and wildlife; when wet it can provide water for animals and may be habitat for amphibians and other aquatic wildlife.

II. Land System

A. Province - Great Plains

B. Section - Missouri Plateau (unglaciated)

C. Subsection - Powder River Basin

D. Landtype Association - Slightly dissected interstream uplands

E. Landtype - Playa

1. Geology - Fluviolacustrine sediments eroded from surrounding uplands.
2. Physiography - Playas are shallow, intermittent, lakes occurring as slightly concave depressions forming small closed basins on upland landforms.
 - a. Elevation range - 4,600 to 5,000 feet m.s.l.
 - b. Slope angles - 0 to 3 percent.
 - c. Dissection - none.
 - d. Drainage pattern - undeveloped.
3. Soils - The only soil is the McKenzie series. This series consists primarily of gray or dark gray clay materials which have eroded from upland soils. McKenzie clay series varies in stage of development as carbonate bearing layers may occur a few inches to several feet below the surface. The surface layer is 2-5 inches thick and has clay to sandy loam texture. Only 15-50 percent of the soil surface is exposed bare soil. The substratum is dominantly a gray clay and may be more than 60 inches deep. Carbonate content is variable, but usually increases with depth. Internal drainage is very slow. Soil reaction is normally strong to very strongly alkaline. Saline and sodic salts are present in some locations.
 - a. Depth range - 40 inches.
 - b. Texture - Clayey.
 - c. Mineralogy - Montmorillontic.
 - d. Series and classification -
 - (1) McKenzie: Typic Haplaquept - fine, montmorillontic calcareous, mesic.

Ecosystem No. 2: Inland saltgrass-western wheatgrass, blue grama, riparian grassland on alluvial low lands with deep saline-alkaline soils.

I. General Description

This ecosystem is confined to alluvial soils in flat, narrow, valleys of stream courses where saline or alkali salts accumulate. These valleys

may be periodically flooded by runoff water. The vegetation is a grass-land community-type dominated by inland saltgrass (Distichlis spicata spp. stricta). The ecosystem is grazed by both domestic livestock and wild-life.

II. Land System

- A. Province - Great plains
- B. Section - Missouri plateau (unglaciated)
- C. Subsection - Powder River Basin
- D. Landtype Association - Flat relatively narrow valleys
- E. Landtype - Alluvial lowland (saline-alkali)
 - 1. Geology - alluvial deposits formed by the erosion of sedimentary rocks.
 - 2. Physiography - Nearly flat, relatively narrow valleys including the present floodplain, adjacent terraces, and fans along drainages. The physiography represents the activities of stream erosion in a semiarid climate involving channel cutting, streambank erosion and deposition along the meanders.
 - a. Elevation range - 4,000 to 5,000 feet m.s.l.
 - b. Slope angle - 0 to 10 percent slopes
 - c. Dissection - slight
 - d. Drainage pattern - dendritic
 - 3. Soils - The Arvada soils have alkali or saline areas and scabby spots where wind erosion has removed the surface soil and exposed the heavy clay subsoil.

The surface soil consists of 4 to 10 inches of light brownish-gray moderately friable noncalcareous loam, clay loam or clay; the upper 1 to 2 inches is usually platy, loose, and mulchlike. The lower part of the surface soil ordinarily contains a sprinkling of light-gray leached silt or includes a thin light-gray layer where it contacts the subsoil. To a depth of about 25 inches, the subsoil is grayish-brown to dark grayish-brown heavy compact clay of prismatic or columnar structure. The column tops are rounded and covered with gray silt where they are best developed. The lower subsoil is grayish-brown to dark-gray heavy clay to clay loam of massive or cloddy structure. The lower subsoil passes into the little altered calcareous heavy parent material, which continues to depths of 6 feet or more. The parent material rests on gray or dark-gray stratified alluvium of variable texture. Lime carbonate is present in the subsoil in disseminated form; streaks and seams of it occur below an average depth of 15 inches.

- a. Depth range - 60 inches
 - b. Texture - Clayey
 - c. Mineralogy - Montmorillontic
 - d. Series and classification
 - (1) Arvada clay loam and loam - Ustollic Natrargid, fine, montmorillontic, mesic.
4. Climate: (General pattern for the Powder River Coal Basin)
- a. Precipitation - 10 to 12 inch precipitation zone.
 - b. Temperature (Average and range)
 - (1) Spring: 43°F. (-22 to 95°F.)
 - (2) Summer: 68°F. (29 to 110°F.)
 - (3) Fall: 47°F. (-20 to 100°F.)
 - (4) Winter: 24°F. (-40 to 69°F.)
 - c. Growing season - 119 to 141 days.
 - d. Sunshine - 60 to 70 percent possible.
 - e. Wind
 - (1) Direction - west to northwest.
 - (2) Velocity - 6 to 8 mph; 30 to 40 mph frequently; maximum March to May.
5. Hydrology - Annual precipitation varies greatly from place to place and may range 50-60 percent from mean annual precipitation. Individual storms are typically of short duration, low volume and limited areal extent. Individual exceptionally intense storms may produce as much runoff as several years normal runoff. High intensity storms usually occur between April and October and between 2 PM and 10 PM, local time. Surface runoff and ground water recharge are severely limited by low precipitation amounts and high evaporation rates. Ground water recharge is further limited where fine textured soils and/or sparse vegetation limit infiltration. Annual runoff is often less than 10 percent of the annual precipitation. Much of the runoff which does occur is during high intensity storms.

III. Vegetation System

- A. Formation - Grassland.
- B. Region - Central and eastern grassland.
- C. Series - Inland saltgrass.
- D. Community Type - Inland saltgrass-western wheatgrass, blue grama, riparian grassland. The dominant species of this community type are inland saltgrass (Distichlis spicata spp. stricta), western wheatgrass (Agropyron smithii) and blue grama (Boutelona gracilis). These three species together contribute about 60 percent of the total herbage production of 600 lb/acre with inland saltgrass contributing 20 to 30

percent of the total. Western wheatgrass is more abundant where subsoil moisture is plentiful. Blue grama may increase in abundance when grazing is heavy or in area with lower soil moisture conditions. Greasewood (Sarcobatus vermiculatus) shrubs are present in this community-type but are not abundant enough to give it a shrubland aspect. Total live vegetation coverage is approximately 30 percent. Litter coverage is slightly greater. (ca. 35-40 percent)

IV. Vegetation System

- A. Formation - Grassland
- B. Region - Central and Eastern Grassland
- C. Series - Western wheatgrass
- D. Community Type - Western wheatgrass-slender spikerush grassland. The dominant species in the western wheatgrass-slender spikerush community type is western wheatgrass (Agropyron smithii). This species produces approximately 40 percent of the average herbage yield of 900 lb/acre. Slender spikerush (Eleocharis acicularis) is co-dominant with western wheatgrass and will comprise about 35 percent of the vegetative cover. The presence of slender spikerush as a co-dominant species is indicative of the almost hydric soil moisture conditions during the growing season. Major species which make up the remaining 25 percent of the vegetation are: foxtail barley (Hordeum jubatum) alkali bluegrass (Poa juncifolia) mat muhly (Muhlenbergia richarsonis). Ground cover of vascular vegetation is about 35 to 40 percent; the cryptogam layer is absent, but the litter layer is quite extensive averaging 50 percent coverage.

Ecosystem No. 3: Bluebunch wheatgrass-blue grama grassland on scoria land with shallow, gravelly soils.

I. General Description

This ecosystem occurs on ridges and hills derived from reddish colored scoria. Soils are shallow and gravelly and tend to be droughty. The general physiognomy is a somewhat sparsely vegetated grassland characterized by scattered tussocks of bluebunch wheatgrass (Agropyron spicatum). The ecosystem provides grazing for livestock and wildlife, and the steeper outcrops may provide nesting or perching site for owls, hawks and other cliff-dwelling birds.

II. Land System

- A. Province - Great plains
- B. Section - Missouri Plateau (unglaciated)
- C. Subsection - Powder River Basin

D. Landtype Association - Slightly dissected interstream uplands

E. Landtype - Scoria land

1. Geology - Reddish colored, clinker type material resulting from fires in coal veins which fused and baked clay and shale materials.
2. Physiography - Numerous outcroppings or knolls of scoria which rise above the general surface of the land. Steep, eroded, strongly dissected areas along escarpments and steepwalled drainage channels.
 - a. Elevation range - 4,500 to 5,000 feet m.s.l.
 - b. Slope angles - 10 to 50 percent slopes.
 - c. Dissection - strong.
 - d. Drainage Pattern - dendritic.
3. Soils - This ecosystem includes Wibaux and Searing soils and rough broken land. The very shallow to shallow Wibaux soils occur on knolls and steep slopes. The texture is gravelly to very gravelly loam and sandy loam. The depth to bedrock is less than 10 inches to 20 inches. Outcrops of unweathered scoria are exposed in some areas. Searing soil normally occurs between the knolls. The surface horizon is reddish brown gravelly loam about 5 inches thick. The subsoil is reddish brown gravelly clay loams. The substratum is friable, calcareous gravelly loam. Bedrock generally occurs at an average depth of 2 feet. Rough broken land includes steep, eroded, strongly dissected areas along escarpments, steepwalled drainage channels and rock outcrops.
 - a. Depth range - Rockoutcrops to 40 inches to bedrock.
 - b. Texture - Gravelly to very gravelly loams and sandy loams.
 - c. Mineralogy - Mixed.
 - d. Series and classification
 - (1) Wibaux - Ustic Torriorthent, loamy-skeletal over fragmental, mixed, non-acid, mesic.
 - (2) Searing - Ustollic Haplargid, fine-loamy, mixed, mesic
 - (3) Rough Broken Land - unclassified.
4. Climate: (General pattern for the Powder River Coal Basin)
 - a. Precipitation - 10 to 12 inch precipitation zone.
 - b. Temperature (Average and range)
 - (1) Spring: 43°F. (-22 to 95°F.)
 - (2) Summer: 68°F. (29 to 110°F.)
 - (3) Fall: 47°F. (-20 to 100°F.)
 - (4) Winter: 24°F. (-40 to 69°F.)
 - c. Growing season - 119 to 141 days.
 - d. Sunshine - 60 to 70 percent possible.
 - e. Wind
 - (1) Direction - west to northwest.
 - (2) Velocity - 6 to 8 mph; 30 to 40 mph frequently; maximum March to May.
5. Hydrology - Annual precipitation varies greatly from place to place and may range 50 to 60 percent from mean annual precipitation.

Individual storms are typically of short duration, low volume and limited areal extent. Individual exceptionally intense storms may produce as much runoff as several years normal runoff. High intensity storms usually occur between April and October and between 2 PM and 10 PM, local time. Surface runoff and ground water recharge are severely limited by low precipitation amounts and high evaporation rates. Ground water recharge is further limited where fine textured soil and/or sparse vegetation limit infiltration. Annual runoff is often less than 10 percent of the annual precipitation. Much of the runoff which does occur is during high intensity storms.

III. Vegetation System

- A. Formation - Grassland.
- B. Region - Central and eastern grasslands.
- C. Series - Bluebunch wheatgrass.
- D. Community Type - Bluebunch wheatgrass-blue grama grassland. The bluebunch community-type is characterized by the presence of scattered tussocks of bluebunch wheatgrass dispersed in a matrix of blue grama (Bouteloua gracilis). This is the only community-type on the lease areas where bluebunch wheatgrass is abundant. However, while it is the most conspicuous species, it may not be the most productive. The most productive species is blue grama which may produce over 50 percent of the average annual yield of 260 lbs/acre.

Other grasses include little bluestem (Andropogon scoparius) which also appears to be confined to the ecosystem, stoneyhills muhly (Muhlenbergia cuspidata), prairie sandreed (Calamovilfa longifolia), and Indian ricegrass (Oryzopsis hymenoides). The presence of these minor species reflects the coarse nature of the parent material and consequent droughty soil conditions. In draws and other areas of higher soil moisture conditions a few shrubs may be present. These include big sagebrush (Artemesia tridentata), skunkbrush sumac (Rhus tribolata) and occasionally stunted, gnarled trees of Rocky Mountain juniper (Juniperus scopulorum). Ground coverage in the bluebunch wheatgrass-blue grama community-type is approximately 25 percent vascular vegetation, 2 percent cryptogams and 15 percent litter.

Ecosystem No. 3a: Bluebunch wheatgrass-blue grama grassland on scoria land with shallow to moderately deep soils.

I. General Description

This ecosystem occurs on ridges and hills derived from reddish colored scoria. Soils are shallow to moderately deep and tend to be droughty. The general physiognomy is a somewhat sparsely vegetated grassland characterized by scattered tussocks of bluebunch wheatgrass (Agropyron spicatum).

The ecosystem provides grazing for livestock and wildlife. The steeper outcrops may provide nesting or perching sites for owls, hawks and other cliff-dwelling birds.

II. Land System

A. Province - Great Plains

B. Section - Missouri Plateau (unglaciaded)

C. Subsection - Powder River Basin

D. Landtype Association - Slightly dissected interstream uplands

E. Landtype - Scoria land

1. Geology - Reddish colored clinker material from fires in coal veins which fused and baked clay and shale materials.
2. Physiography - undulating to rolling topography including scattered outcrops of scoria. Drainage systems are well developed.
 - a. Elevation range - 4,500 to 5,000 feet m.s.l.
 - b. Slope angles - 5 to 20 percent slopes
 - c. Dissection - moderate
 - d. Drainage Pattern - dendritic
3. Soils - This ecosystem is predominantly Searing gravelly loam. Searing gravelly loam is developing in scoria. The surface horizon is reddish brown gravelly loam about 5 inches thick. The subsoil is reddish brown gravelly clay loam. The substratum is friable, calcareous gravelly loam. Bedrock generally occurs at an average depth of 2 feet. Internal drainage is good. The very shallow to shallow Wibaux soils and some rock outcrops occur in this ecosystem.
 - a. Depth range - generally 20 to 40 inches, includes some shallower soils and outcrops.
 - b. Texture - gravelly loam to clay loam.
 - c. Mineralogy - mixed.
 - d. Series and classification -
 - (1) Searing - Ustollic Haplargid, fine-loamy, mixed mesic.
4. Climate: (General pattern for the Powder River Coal Basin)
 - a. Precipitation - 10 to 12 inch precipitation zone.
 - b. Temperature (Average and range)
 - (1) Spring: 43°F. (-22 to 95°F.)
 - (2) Summer: 68°F. (29 to 110°F.)
 - (3) Fall: 47°F. (-20 to 100°F.)
 - (4) Winter: 24°F. (-40 to 69°F.)
 - c. Growing season - 119 to 141 days.
 - d. Sunshine - 60 to 70 percent possible.
 - e. Wind
 - (1) Direction - west to northwest.
 - (2) Velocity - 6 to 8 mph; 30 to 40 mph frequently; maximum March to May.

5. Hydrology - Annual precipitation varies greatly from place to place and may range 50 to 60 percent from mean annual precipitation. Individual storms are typically of short duration, low volume and limited areal extent. Individual exceptionally intense storms may produce as much runoff as several years normal runoff. High intensity storms usually occur between April and October and between 2 PM and 10 PM, local time. Surface runoff and ground water recharge are severely limited by low precipitation amounts and high evaporation rates. Ground water recharge is further limited where fine textured soils and/or sparse vegetation limit infiltration. Annual runoff is often less than 10 percent of the annual precipitation. Much of the runoff which does occur is during high intensity storms.

III. Vegetation System

- A. Formation - Grassland.
- B. Region - Central and eastern grasslands.
- C. Series - Bluebunch wheatgrass.
- D. Community Type - Bluebunch wheatgrass-blue grama grassland. The bluebunch community-type is characterized by the presence of scattered tussocks of bluebunch wheatgrass dispersed in a matrix of blue grama (Bouteloua gracilis). This is the only community-type on the lease areas where bluebunch wheatgrass is abundant. However, while it is most conspicuous species, it may not be the most productive. The most productive species is blue grama which may produce over 50 percent of the average annual yield of 260 lbs/acre.

Other grasses include little bluestem (Andropogon scoparius) which also appears to be confined to the ecosystem, stoneyhills muhly (Muhlenbergia cuspidata), prairie sandreed (Calamovilfa longifolia), and Indian ricegrass (Oryzopsis hymenoides). The presence of these minor species reflects the coarse nature of the parent material and consequent droughty soil conditions. In draws and other areas of higher soil moisture conditions a few shrubs may be present. These include big sagebrush (Artemisia tridentata), skunkbrush sumac (Rhus trilobata), and occasionally stunted, gnarled trees of Rocky Mountain juniper (Juniperus scopulorum). Ground coverage in the bluebunch wheatgrass-blue grama community-type is approximately 25 percent vascular vegetation, 2 percent cryptogams and 15 percent litter.

Ecosystem No. 4: Big sagebrush/western wheatgrass-blue grama shrub steppe on dissected sideslopes with moderately deep, clayey, soils.

I. General Description

This ecosystem occurs on sideslope terrain which is somewhat dissected. Soils are shallow to moderately deep and tend to be clay loam or clayey in texture. The vegetation is a shrub steppe with big sagebrush (Artemisia

tridentata), the shrub layer dominant. The herbacious layer is characterized by western wheatgrass (Agropyron smithii) and blue grama (Bouteloua gracilis). This is a major ecosystem on the lease area. It provides grazing for livestock and wildlife.

II. Land System

A. Province - Great Plains

B. Section - Missouri Plateau

C. Subsection - Powder River Basin

D. Landtype Association - Slightly dissected interstream uplands

E. Landtype - Dissected sideslopes

1. Geology - Weathered shale of the Lance, Wasatch and Fort Union Formations.
2. Physiography - These dissected sideslopes flank the gently rolling upland surfaces. Relief is gentle and the landscape consists of rolling, small rounded hills descending from the upper surface toward the valley bottoms.
 - a. Elevation range - 4,500 to 5,000 feet
 - b. Slope angles - 10 to 30 percent
 - c. Dissection - moderate
 - d. Drainage pattern - dendritic
3. Soils - The dominant soil is the Renohill series. This series consists primarily of light-colored moderately friable soils having a fine textured, compact, slowly permeable subsoil. The 3 to 10 inch surface soils is mulch like in the upper 1 or 2 inches and soft granular in the clay loam layer below. The upper subsoil is compact clay with prismatic or blocky structure. As a rule, the upper subsoil contains no free lime carbonates. The lower subsoil is more friable with an abundance of lime carbonate. The weathered parent shale occurs at depths of 20 to 30 inches. Internal drainage is slow due to the compact subsoil.
 - a. Depth range - less than 10 inches to 30 inches.
 - b. Texture - clay loam surface; clay subsoil.
 - c. Mineralogy - Montmorillontic.
 - d. Series and classification
 - (1) Renohill, clay loam
 - (2) Ustollic Haplargid, fine, montmorillontic, mesic
4. Climate: (General pattern for the Powder River Coal Basin)
 - a. Precipitation - 10 to 12 inch precipitation zone.
 - b. Temperature (Average and range)
 - (1) Spring: 43°F. (-22 to 95°F.)
 - (2) Summer: 68°F. (29 to 110°F.)
 - (3) Fall: 47°F. (-20 to 100°F.)
 - (4) Winter: 24°F. (-40 to 69°F.)
 - c. Growing season - 119 to 141 days.
 - d. Sunshine - 60 to 70 percent possible.

- e. Wind
 - (1) Direction - west to northwest.
 - (2) Velocity - 6 to 8 mph; 30 to 40 mph frequently; maximum March to May.
- 5. Hydrology - Annual precipitation varies greatly from place to place and may range 50 to 60 percent from mean annual precipitation. Individual storms are typically of short duration, low volume and limited areal extent. Individual exceptionally intense storms may produce as much runoff as several years normal runoff. High intensity storms usually occur between April and October and between 2 PM and 10:00 PM, local time. Surface runoff and ground water recharge are severely limited by low precipitation amounts and high evaporation rates. Ground water recharge is further limited where fine textured soils and/or sparse vegetation limit infiltration. Annual runoff is often less than 10 percent of the annual precipitation. Much of the runoff which does occur is during high intensity storms.

III. Vegetation System

- A. Formation - Shrubland
- B. Region - Western shrub
- C. Series - Big sagebrush
- D. Community-Type - Big sagebrush/western wheatgrass-blue grama shrub steppe.

The shrub layer of this plant community is composed almost entirely of big sagebrush. The height of this layer generally does not exceed 18- to 24-inches. Density will range from scattered to closely spaced, but the crowns of individual plants rarely touch. Canopy coverage of big sagebrush is 4 to 6 percent range and total coverage of live vegetation about 35 to 40 percent. Litter and cryptogams cover about 35 percent of the ground surface.

The herbaceous layer is composed of species common to the Northern Great Plains. Grasses and graminoids predominate, but forbs are evident in the early part of the growing season (April-May). Western wheatgrass (Agropyron smithii) and blue grama (Bouteloua gracilis) are the herbaceous layer dominant and the former is often the most productive. Important subordinate graminoids and grasses are thread-leaf sedge (Carex filifolia). Sandberg bluegrass (Poa sandbergii) and prairie junegrass (Koelaria cristata). Average annual herbage production is 350 lbs/acre.

Ecosystem No. 4a: Big sagebrush/western wheatgrass-blue grama shrub steppe on dissected sideslopes with moderately deep, clayey soils.

I. General Description

This ecosystem occurs on sideslope terrain which is somewhat dissected. Soils are shallow to moderately deep and tend to be clayey in texture. The vegetation is a shrub steppe with big sagebrush (Artemesia tridentata) as the shrub layer dominant. The herbaceous layer is characterized by western wheatgrass (Agropyron smithii) and blue grama (Bouteloua gracilis). This is a major ecosystem on the lease area. It provides grazing for livestock and wildlife.

II. Land System

A. Province - Great Plains

B. Section - Missouri Plateau (unglaciated)

C. Subsection - Powder River Basin

D. Landtype Association - Slightly dissected interstream uplands

E. Landtype - Dissected sideslopes

1. Geology - Weathered shale of the Lance, Wasatch and Fort Union Formations.
2. Physiography - These dissected sideslopes flank the gently rolling upland surfaces. Relief is gentle and the landscape consists of rolling, small rounded hills descending from the upper surface toward the valley bottoms.
 - a. Elevation range - 4,500 to 5,000 feet
 - b. Slope angles - 10 to 30 percent
 - c. Dissection - Moderate
 - d. Drainage pattern - dendritic
3. Soils - The dominant soil is the Renohill series. This series consists primarily of light-colored moderately friable soils having a fine textured, compact, slowly permeable subsoil. The 3 to 10 inch surface soil is mulchlike in the upper 1 or 2 inches and soft granular in the loam layer below. The upper subsoil is compact clay loam to clay with prismatic or blocky structure. Generally the upper subsoil is more friable with an abundance of lime carbonate. The weathered parent shale occurs at depths of 10 to 30 inches. Internal drainage is slow due to the compact subsoil.
 - a. Depth range - less than 10 to 30 inches
 - b. Texture - sandy loam to loam surface; clay loam to clay subsoil
 - c. Mineralogy - montmorillonitic
 - d. Series and classification
 - (1) Renohill loam, rolling phase
 - (2) Ustollic Haplargid, fine, montmorillonitic, mesic
4. Climate: (General pattern for the Powder River Coal Basin)
 - a. Precipitation - 10 to 12 inch precipitation zone.

- b. Temperature (Average and range)
 - (1) Spring: 43°F. (-22 to 95°F.)
 - (2) Summer: 68°F. (29 to 110°F.)
 - (3) Fall: 47°F. (-20 to 100°F.)
 - (4) Winter: 24°F. (-40 to 69°F.)
 - c. Growing season - 119 to 141 days.
 - d. Sunshine - 60 to 70 percent possible.
 - e. Wind
 - (1) Direction- west to northwest.
 - (2) Velocity - 6 to 8 mph; 30 to 40 mph frequently; maximum March to May.
5. Hydrology - Annual precipitation varies greatly from place to place and may range 50 to 60 percent from mean annual precipitation. Individual storms are typically of short duration, low volume and limited areal extent. Individual exceptionally intense storms may produce as much runoff as several years normal runoff. High intensity storms usually occur between April and October and between 2 PM and 10 PM, local time. Surface runoff and ground water recharge are severely limited by low precipitation amounts and high evaporation rates. Ground water recharge is further limited where fine textured soils and/or sparse vegetation limit infiltration. Annual runoff is often less than 10 percent of the annual precipitation. Much of the runoff which does occur is during high intensity storms.

III. Vegetation System

- A. Formation - Shrubland
- B. Region - Western shrub
- C. Series - Big sagebrush
- D. Community-type - Big sagebrush/western wheatgrass-blue grama shrub steppe.

The shrub layer of this plant community is composed almost entirely of big sagebrush. The height of this layer generally does not exceed 18 to 24 inches. Density will range from scattered to closely spaced, but the crowns of individual plants rarely touch. Canopy coverage of big sagebrush is 4 to 6 percent range and total coverage of live vegetation about 35 to 40 percent. Litter and cryptograms cover about 35 percent of the ground surface.

The herbaceous layer is composed of species common to the Northern Great Plains. Grasses and graminoids predominate, but forbs are evident in the early part of the growing season (April-May). Western wheatgrass (Agropyron smithii) and blue grama (Bouteloua gracilis) are the herbaceous layer dominant and the former is often the most productive. Important subordinate graminoids and grasses are thread-leaf sedge (Carex filifolia). Sandberg bluegrass (Poa sandbergii) and prairie junegrass (Koelaria cristata). Average annual herbage production is 350 lbs/acre.

Ecosystem No. 5: Big sagebrush/western wheatgrass-blue grama shrub steppe on rough broken land side slopes with shallow clayey soils.

I. General Description

This ecosystem is present on rough and broken topography. Soils are shallow, textures tend to be somewhat clayey, but drainage is not impeded. The vegetation is a very open shrub-steppe of big sagebrush (Artemesia tridentata) with a sparse herbaceous understory of grasses. This is a major ecosystem on the lease areas. It is grazed by both livestock and wildlife, but is low in production of herbage.

II. Land System

A. Province - Great Plains

B. Section - Missouri Plateau (unglaciated)

C. Subsection - Powder River Basin

D. Landtype Association - Slightly dissected interstream uplands.

E. Landtype - Rough and broken land sideslopes

1. Geology - Interbedded shale, sandstone and limestone.
2. Physiography - Rough eroded and deeply dissected sideslope areas along escarpments, steep-walled drainage channel and rock outcrops.
 - a. Elevation range - 4,500 to 5,000 feet m.s.l.
 - b. Slope angles - 20 to 50 percent slopes.
 - c. Dissection - strong
 - d. Drainage pattern - dendritic
3. Soils - Small areas of shallow stony soils and deep stone free soils are intermingled with the areas of rock outcrops. The mixed pattern is related to the interbedded sandstone and shales compounded by strong dissection.
 - a. Depth range - 0 to 20 inches.
 - b. Texture - loamy and clayey.
 - c. Mineralogy - mixed and montmorillonitic
 - d. Series and classification
 - (1) Rough broken land - unclassified.
 - (2) Ustic Torriorthents loamy and clayey, mixed and montmorillonitic, calcareous, mesic, shallow.
4. Climate: (General pattern for the Powder River Coal Basin)
 - a. Precipitation - 10 to 12 inch precipitation zone.
 - b. Temperature (Average and range)
 - (1) Spring: 43°F. (-22 to 95°F.)
 - (2) Summer: 68°F. (29 to 110°F.)
 - (3) Fall: 47°F. (-20 to 100°F.)
 - (4) Winter: 24°F. (-40 to 69°F.)
 - c. Growing season - 119 to 141 days.
 - d. Sunshine - 60 to 70 percent possible.

- e. Wind
 - (1) Direction - west to northwest.
 - (2) Velocity - 6 to 8 mph; 30 to 40 mph frequently; maximum March to May.
- 5. Hydrology - Annual precipitation varies greatly from place to place and may range 50 to 60 percent from mean annual precipitation. Individual storms are typically of short duration, low volume and limited areal extent. Individual exceptionally intense storms may produce as much runoff as several years normal runoff. High intensity storms usually occur between April and October and between 2 PM and 10 PM, local time. Surface runoff and ground water recharge are severely limited by low precipitation amounts and high evaporation rates. Ground water recharge is further limited where fine textured soils and/or sparse vegetation limit infiltration. Annual runoff is often less than 10 percent of the annual precipitation. Much of the runoff which does occur is during high intensity storms.

III. Vegetation System

- A. Formation - Shrubland
- B. Region - Western shrub
- C. Series - Big sagebrush
- D. Community-type - Big sagebrush/western wheatgrass-blue grama shrub steppe.

The shrub layer of this community-type is composed entirely of big sagebrush (Artemesia tridentata). The height of this layer does not usually exceed 12 inches and the general aspect is a very open stand of low-growing big sagebrush with a poorly developed herbaceous understory. Major grasses in the understory are western wheatgrass (Agropyron smithii), blue grama (Bouteloua gracilis) and prairie junegrass (Koelaria cristata). These grasses, plus big sagebrush will provide 60 to 70 percent of the total composition. Herbage production is low -- 200 lb/acre as is ground coverage, which will average only about 20 percent, with big sagebrush contributing 10 to 15 percent of this or about 2 to 3 percent actual ground coverage. Litter cover is approximately 15 percent of the ground surface and cryptogams cover 1 to 2 percent.

Ecosystem No. 6: Big sagebrush/needleandthread/blue grama shrub steppe on nearly level to gently sloping uplands with moderately deep loamy soils.

I. General Description

This ecosystem is characterized by gently sloping to rolling uplands where soil texture is loamy to sandy. The vegetation is a shrub steppe community

type with big sagebrush as the shrub-layer dominant. The understory is composed of grasses and forbs common to the Great Plains grasslands. This is the most widely distributed ecosystem of the lease area. It is used by both livestock and wildlife for grazing and is moderately productive.

II. Land System

- A. Province - Great Plains
- B. Section - Missouri Plateau (unglaciated)
- C. Subsection - Powder River Basin
- D. Landtype Association - Slightly dissected interstream uplands
- E. Landtype - Gently sloping to rolling uplands.
 - 1. Geology - Weathered sandy shale or loam stone of the Lance Formation.
 - 2. Physiography - These gently sloping to rolling uplands occur as table lands above the surrounding gently rolling sideslope landscape.
 - a. Elevation range - 4,500 to 5,000 feet.
 - b. Slope angles - 2 to 15 percent
 - c. Dissection - slight
 - d. Drainage pattern - dendritic
 - 3. Soils - The Ulm soils are loamy or slightly sandy, generally stone-free, soil of adequate drainage and excellent tilth. They have friable grayish-brown surface soil, a light-brown or reddish upper subsoil, and a light grayish-brown or reddish lower subsoil in which lime carbonate has accumulated. The reddish subsoil phase has developed from erosional sediments derived from scoria beds. Internal drainage is moderate due to the medium textured subsoils.
 - a. Depth range - 20 to 40 inches.
 - b. Texture - loams, sandy loams and light clay loams.
 - c. Mineralogy - mixed.
 - d. Series and classification
 - (1) Ulm and Ulm, reddish subsoil phase, loams.
 - (2) Ustollic Haplargids, fine-loamy, mixed, mesic.
 - 4. Climate: (General pattern for the Powder River Coal Basin)
 - a. Precipitation - 10 to 12 inch precipitation zone.
 - b. Temperature (Average and range)
 - (1) Spring: 43°F. (-22 to 95°F.)
 - (2) Summer: 68°F. (29 to 110°F.)
 - (3) Fall: 47°F. (-20 to 100°F.)
 - (4) Winter: 24°F. (-40 to 69°F.)
 - c. Growing season - 119 to 141 days.
 - d. Sunshine - 60 to 70 percent possible.

- e. Wind
 - (1) Direction - west to northwest.
 - (2) Velocity - 6 to 8 mph; 30 to 40 mph frequently; maximum March to May.
- 5. Hydrology - Annual precipitation varies greatly from place to place and may range 50 to 60 percent from mean annual precipitation. Individual storms are typically of short duration, low volume and limited areal extent. Individual exceptionally intense storms may produce as much runoff as several years normal runoff. High intensity storms usually occur between April and October and between 2 P.M. and 10 P.M., local time. Surface runoff and ground water recharge are severely limited by low precipitation amounts and high evaporation rates. Ground water recharge is further limited where fine textured soils and/or sparse vegetation limit infiltration. Annual runoff is often less than 10 percent of the annual precipitation. Much of the runoff which does occur is during high intensity storms.

III. Vegetation System

- A. Formation - Shrubland
- B. Region - Western shrub
- C. Series - Big sagebrush
- D. Community-type - Big sagebrush/needleandthread-blue grama shrub steppe.

The shrub layer in this community type is composed solely of big sagebrush (Artemisia tridentata). This layer has a canopy coverage of approximately 5 to 7 percent and the height of the tallest shrub will rarely be more than 18 to 24 inches. The characteristic herbaceous layer species is needleandthread (Stipa comata), but blue grama (Bouteloua gracilis) is generally the most productive grass. It produces 40 to 45 percent of the total annual herbage crop of 450 lbs. per acre. Other grasses include Indian ricegrass. (Oryzopsis hymenoides), prairie junegrass (Koeleria cristata), sandberg bluegrass (Poa sandbergii) and threadleaf sedge (Carex filifolia). Total ground coverage of live vegetation (including big sagebrush) is 30 to 35 percent. Litter and cryptogams cover 35 to 40 percent of the ground surface.

Ecosystem No. 6a: Big sagebrush/needleandthread-blue grama shrub steppe on dissected sideslopes with shallow to moderately deep loamy soils.

I. General Description

This ecosystem occurs on sideslopes terrain which is dissected. Soils are loamy in texture and shallow to moderately deep. The vegetation is a shrub steppe community-type with big sagebrush as the shrub layer dominant.

The understory is composed of grasses and forbs common to the Great Plains grassland. This is the most widely distributed ecosystem of the lease area. It is used by both livestock and wildlife for grazing and is moderately productive.

II. Land System

A. Province - Great Plains

B. Section - Missouri Plateau (unglaciaded)

C. Subsection - Powder River Basin

D. Landtype Association - Slightly dissected interstream uplands

E. Landtype - Dissected sideslopes

1. Geology - Weathered sandy shale or loamstone of the Lance Formation.
2. Physiography - These dissected sideslopes flank the gently rolling upland surfaces. Relief is gentle and the landscape consists of rolling, small rounded hills descending from the upper surface toward the valley bottoms.
 - a. Elevation range - 4,500 to 5,000 feet m.s.l.
 - b. Slope angles - 10 to 30 percent slope
 - c. Dissection - moderate
 - d. Drainage pattern - dendritic
3. Soils - The Ulm soils are loamy or slightly sandy and generally stone free. The surface horizon is friable loam 3 to 7 inches thick. The subsoil ranges from sandy clay loam to clay loam. The calcareous substratum ranges from sandy loam to clay loam and extends to weathered bedrock at depths of 20 to 40 inches. Internal drainage is good.
 - a. Depth range - 20 to 40 inches.
 - b. Texture - loam, sandy loam, clay loam.
 - c. Mineralogy - mixed.
 - d. Series and classification
 - (1) Ulm loam, rolling phase
 - (2) Ustollic Haplargids, fine-loamy, mixed, mesic
4. Climate: (General pattern for the Powder River Coal Basin)
 - a. Precipitation - 10 to 12 inch precipitation zone.
 - b. Temperature (Average and range)
 - (1) Spring: 43°F. (-22 to 95°F.)
 - (2) Summer: 68°F. (29 to 110°F.)
 - (3) Fall: 47°F. (-20 to 100°F.)
 - (4) Winter: 24°F. (-40 to 69°F.)
 - c. Growing season - 119 to 141 days.
 - d. Sunshine - 60 to 70 percent possible.
 - e. Wind
 - (1) Direction - west to northwest.
 - (2) Velocity - 6 to 8 mph; 30 to 40 mph frequently; maximum March to May.

5. Hydrology - Annual precipitation varies greatly from place to place and may range 50 to 60 percent from mean annual precipitation. Individual storms are typically of short duration, low volume and limited areal extent. Individual exceptionally intense storms may produce as much runoff as several years normal runoff. High intensity storms usually occur between April and October and between 2 P.M. and 10 P.M., local time. Surface runoff and ground water recharge are severely limited by low precipitation amounts and high evaporation rates. Ground water recharge is further limited where fine textured soils and/or sparse vegetation limit infiltration. Annual runoff is often less than 10 percent of the annual precipitation. Much of the runoff which does occur is during high intensity storms.

III. Vegetation System

- A. Formation - Shrubland
- B. Region - Western shrub
- C. Series - Big sagebrush
- D. Community-type Big sagebrush/needleandthread-blue grama shrub steppe.

The shrub layer in this community-type is composed solely of big sagebrush (Artemesia tridentata). This layer has a canopy coverage of approximately 5 to 7 percent and the height of the tallest shrub will rarely be more than 18 to 24 inches. The characteristic herbaceous layer species is needleandthread (Stipa comata), but blue grama (Bouteloua gracilis) is generally the most productive grass. It produces 40 to 45 percent of the total annual herbage crop of 450 lbs. per acre. Other grasses include Indian ricegrass (Oryzopsis hymenoides), prairie junegrass (Koeleria cristata), sandberg bluegrass (Poa sandbergii) and threadleaf sedge (Carex filifolia). Total ground coverage of live vegetation (including big sagebrush) is 30 to 35 percent. Litter and cryptogams cover 35 to 40 percent of the ground surface.

Ecosystem No. 6b: Big sagebrush/needleandthread-blue grama shrub steppe on gently sloping to rolling uplands with shallow loamy soils.

I. General Description

This ecosystem is characteristic of nearly level to gently sloping uplands where soil texture is loamy to sandy. The vegetation is a shrub steppe community-type with big sagebrush as the shrub-layer dominant. The understory is composed of grasses and forbs common to the Great Plains grassland. This is the most widely distributed ecosystem of the lease area. It is used by both livestock and wildlife for grazing and is moderately productive.

II. Land System

A. Province - Great Plains

B. Section - Missouri Plateau (unglaciated)

C. Subsection - Powder River Basin

D. Landtype Association - Slightly dissected interstream uplands.

E. Landtype - Gently sloping to rolling uplands

1. Geology - Weathered sandy shale or loamstone of the Lance Formation.
2. Physiography - These gently sloping to rolling uplands occur as table lands above the surrounding gently rolling sideslopes landscape. Thought of by some as a plateau-like rolling divide.
 - a. Elevation range - 4,500 to 5,000 feet.
 - b. Slope angles - 10 to 30 percent
 - c. Dissection - moderate
 - d. Drainage pattern - dendritic
3. Soils - The surface soil is about 6 inches of light grayish-brown to light olive-brown soft granular clay loam. In most areas it is noncalcareous in the upper part, but contains some free lime carbonates in the lower. The surface 2½ inch layer is normally mulchlike or platy. The subsoil is light grayish-brown or yellowish-brown, massive or weakly prismatic, highly calcareous silty clay loam that becomes more loamy and friable with depth. Internal drainage is moderate due to the medium textured subsoils.
 - a. Depth range - 10 to 20 inches.
 - b. Texture - loams, silty clay loams, and clay loams.
 - c. Mineralogy - mixed
 - d. Series and classification
 - (1) Ulm clay loam shallow phase
 - (2) Ustollic Haplargid, fine-loamy, mixed, mesic shallow
4. Climate: (General pattern for the Powder River Coal Basin)
 - a. Precipitation - 10 to 12 inch precipitation zone.
 - b. Temperature (Average and range)
 - (1) Spring: 43°F. (-22 to 95°F.)
 - (2) Summer: 68°F. (29 to 110°F.)
 - (3) Fall: 47°F. (-20 to 100°F.)
 - (4) Winter: 24°F. (-40 to 69°F.)
 - c. Growing season - 119 to 141 days.
 - d. Sunshine - 60 to 70 percent possible.
 - e. Wind
 - (1) Direction - west to northwest.
 - (2) Velocity - 6 to 8 mph; 30 to 40 mph frequently; maximum March to May.

5. Hydrology - Annual precipitation varies greatly from place to place and may range 50 to 60 percent from mean annual precipitation. Individual storms are typically of short duration, low volume and limited areal extent. Individual exceptionally intense storms may produce as much runoff as several years normal runoff. High intensity storms usually occur between April and October and between 2 PM or 10 PM, local time. Surface runoff and ground water recharge are severely limited by low precipitation amounts and high evaporation rates. Ground water recharge is further limited where fine textured soils and/or sparse vegetation limit infiltration. Annual runoff is often less than 10 percent of the annual precipitation. Much of the runoff which does occur is during high intensity storms.

III. Vegetation System

- A. Formation - Shrubland
- B. Region - Western Shrub
- C. Series - Big Sagebrush
- D. Community-type - Big sagebrush/needleandthread-blue grama shrub steppe.

The shrub layer in this community type is composed solely of big sagebrush (Artemisia tridentata). This layer has a canopy coverage of approximately 5 to 7 percent and the height of the tallest shrub will rarely be more than 18 to 24 inches. The characteristic herbaceous layer species is needleandthread (Stipa comata), but blue grama (Bouteloua gracilis) is generally the most productive grass. It produces 40 to 45 percent of the total annual herbage crop of 450 lbs. per acre. Other grasses include Indian ricegrass (Oryzopsis hymenoides), prairie junegrass (Koeleria cristata) sandberg bluegrass (Poa sandbergii) and threadleaf sedge (Carex filifolia). Total ground coverage of live vegetation (including big sagebrush) is 30 to 35 percent. Litter and cryptogams cover 35 to 40 percent of the ground surface.

Ecosystem No. 7: Big sagebrush/blue grama shrub steppe on gently sloping uplands with moderately deep clayey soils.

I. General Description

This ecosystem is characteristic of nearly level to gently sloping uplands with clayey textured soils. The vegetation is a shrub steppe community-type with big sagebrush as the shrub-layer dominant. The understory is composed of grasses and forbs common to the Great Plains grassland. The

ecosystem is used by both livestock and wildlife for grazing and is moderately productive.

II. Land System

A. Province - Great Plains

B. Section - Missouri Plateau (unglaciated)

C. Sub-Section - Powder River Basin

D. Landtype Association - Slightly dissected interstream uplands.

E. Landtype - Gently sloping to nearly level uplands.

1. Geology - Weathered shale of the Lance, Wasatch, and Fort Union Formations.
2. Physiography - These gently sloping to rolling uplands occur as table lands above the surrounding gently rolling sideslope landscape.
 - a. Elevation range - 4,500 to 5,000 feet.
 - b. Slope angles - 2 to 15 percent.
 - c. Dissection - Slight.
 - d. Drainage pattern - dendritic.
3. Soils - The dominant soil is the Renohill series. This series consists primarily of light-colored moderately friable soils having a fine textured, compact, slowly permeable subsoil. The 3 to 10 inch surface soil is mulchlike in the upper 1 or 2 inches and soft granular in the clay loam layer below. The upper subsoil is compact clay with prismatic or blocky structure. As a rule, the upper subsoil contains no free lime carbonates. The lower subsoil is more friable with an abundance of lime carbonate. The weathered parent shale occurs at depths of 20 to 40 inches. Internal drainage is slow due to the compact subsoil. Renohill loam is included in this unit due to limited acreage. This soil unit differs by having a loam surface and responds to some management activities in different manners.
 - a. Depth range - 20 to 40 inches.
 - b. Texture - Clay loam surface; clay subsoil. Inclusions of loam surface.
 - c. Mineralogy - Montmorillontic.
 - d. Series and classification:
 - (1) Renohill, clay loam (inclusions of loam)
 - (2) Ustollic Haplargid, fine, montmorillontic, mesic
4. Climate - (General pattern for the Powder River Coal Basin)
 - a. Precipitation - 10 to 12 inch precipitation zone.
 - b. Temperature (Average and range)
 - (1) Spring: 43°F. (-22 to 95°F.)
 - (2) Summer: 68°F. (29 to 100°F.)
 - (3) Fall: 47°F. (-20 to 100°F.)
 - (4) Winter: 24°F. (-40 to 69°F.)
 - c. Growing season - 119 to 141 days.
 - d. Sunshine - 60 to 70 percent possible.

- e. Wind
 - (1) Direction - west to northwest
 - (2) Velocity - 6 to 8 mph; 30 to 40 mph frequently; maximum March to May.
- 5. Hydrology - Annual precipitation varies greatly from place to place and may range 50 to 60 percent from mean annual precipitation. Individual storms are typically of short duration, low volume and limited areal extent. Individual exceptionally intense storms may produce as much runoff as several years normal runoff. High intensity storms usually occur between April and October and between 2 PM and 10 PM, local time. Surface runoff and ground water recharge are severely limited by low precipitation amounts and high evaporation rates. Ground water recharge is further limited where fine textured soils and/or sparse vegetation limit infiltration. Annual runoff is often less than 10 percent of the annual precipitation. Much of the runoff which does occur is during high intensity storms.

III. Vegetation System

- A. Formation - Shrubland
- B. Region - Western Shrub
- C. Series - Big sagebrush
- D. Community type - Big sagebrush/blue grama

The big sagebrush/blue grama community type is very similar in species composition to the big sagebrush/blue grama - needleandthread community type except that needleandthread is not present as a co-dominant in the herbaceous layer. Total vegetation coverage is approximately 35 percent with big sagebrush contributing 4 to 6 percent of this. Blue grama coverage will be in the range of 18 to 20 percent. Litter and cryptograms together cover 35 to 40 percent of the ground surface. The community-type is relatively productive for the area and will produce 350 to 400 lbs/acre of herbage in a normal year.

RAILROAD APPLICATION TO ICC

BEFORE THE
INTERSTATE COMMERCE COMMISSION

APPLICATION OF BURLINGTON NORTHERN)
INC. AND CHICAGO AND NORTH WESTERN)
TRANSPORTATION COMPANY PURSUANT TO) FINANCE DOCKET NO.
SECTION 1(18) OF THE INTERSTATE)
COMMERCE ACT FOR AUTHORITY TO CON-)
STRUCT AND OPERATE A LINE OF RAILROAD)
IN CONVERSE AND CAMPBELL COUNTIES,)
WYOMING)

APPLICATION
AND
ENVIRONMENTAL IMPACT STATEMENT
INDICATING NO SIGNIFICANT ADVERSE
ENVIRONMENTAL IMPACT

ANTHONY KANE
FRANK S. FARRELL
RICHARD M. GLEASON

RICHARD M. FREEMAN
LOUIS T. DUERINCK

Attorneys for Applicant
Burlington Northern Inc.
176 East Fifth Street
St. Paul, Minnesota 55101

Attorneys for Applicant
Chicago and North Western
Transportation Company
400 West Madison Street
Chicago, Illinois 60606

Chicago, Illinois
January 31, 1974

BEFORE THE
INTERSTATE COMMERCE COMMISSION

APPLICATION OF BURLINGTON NORTHERN)	
INC. AND CHICAGO AND NORTH WESTERN)	
TRANSPORTATION COMPANY PURSUANT TO)	FINANCE DOCKET NO.
SECTION 1(18) OF THE INTERSTATE)	
COMMERCE ACT FOR AUTHORITY TO CON-)	
STRUCT AND OPERATE A LINE OF RAILROAD)	
IN CONVERSE AND CAMPBELL COUNTIES,)	
WYOMING)	

APPLICATION

For their application under Section 1(18) of the Interstate Commerce Act, Burlington Northern Inc. (Burlington Northern) and Chicago and North Western Transportation Company (North Western) state as follows, pursuant to Section 1120.1 et seq. of the Code of Federal Regulations, Title 49:

(a) The exact corporate name of applicants is: Burlington Northern Inc., and Chicago and North Western Transportation Company.

(b) Applicants are carriers by railroad subject to the Interstate Commerce Act.

(c) Burlington Northern was incorporated January 13, 1961, in the State of Delaware as Great Northern Pacific and

Burlington Lines, Inc. The name was subsequently changed to Burlington Northern Inc. It is authorized to, and does, operate as a common carrier by railroad in Wyoming and 15 other states. North Western was incorporated on March 24, 1970, in the state of Delaware under the name North Western Employees Transportation Corporation. Its present name was adopted in May 1972. Since June 1, 1972, pursuant to the authority granted in Finance Docket Nos. 26371 and 26372, it has operated as a common carrier by railroad in Wyoming and ten other states.

(d) It is proposed to construct a new line of railroad as a main line from a point on Burlington Northern's existing Gillette (Wyoming) branch at approximately Milepost 13 southerly through Campbell and Converse Counties to applicant North Western's present line of railroad at Fisher and Shawnee, Wyoming. That portion of the proposed line lying between Burlington Northern's Gillette branch and a point in Township 46 North will be constructed and operated solely by applicant Burlington Northern. The remainder of the line will be jointly constructed, owned and operated by both applicants.

(e) The entire line of railroad will be located in Campbell and Converse Counties, Wyoming.

(f) The proposed Burlington Northern line will connect with applicant Burlington Northern's existing Gillette branch at approximately Milepost 13 and will extend in a southerly direction to the beginning of joint trackage in Township 46 North. This joint line will connect with applicant North Western's main line at two points. The most easterly connection will be approximately at Milepost 521.1 at Shawnee and the westerly connection at approximately Milepost 527.8 at Fisher, both points being on applicant North Western's present line from Chadron, Nebraska through Douglas, Wyoming. None of the proposed line will pass through any incorporated city or village.

(g) The total length of the line will be approximately 116 miles plus spur tracks, of which approximately 96 miles of main line will be joint line and approximately 10 miles of which will be Burlington Northern sole ownership line.

(h) The line is to be constructed for the movement of low sulphur coal which is being produced in the area which the line will traverse. The coal will move and be marketed in the Midwest, East, South, and Southwest. Mines are to be opened along the route of the proposed line to meet the growing demand for coal with low pollutant characteristics. The most economical and efficient means by which this coal can be

transported to power generation sites is by rail over the proposed line.

(i) Neither applicant has traffic nor financial arrangements with any other corporation or corporations respecting this line. Construction of the line will be financed by applicants.

(j) Authorization to file this application was given by Burlington Northern's Board of Directors at a regular meeting held on January 14, 1974 at St. Paul, Minnesota and will be given by North Western's Directors at its regular meeting in Chicago, Illinois on February 25, 1974.

(k) Communications regarding this application should be addressed to:

Richard M. Gleason
Assistant General Counsel
Burlington Northern Inc.
176 East Fifth Street
St. Paul, Minnesota 55101

Louis T. Duerinck
Assistant General Counsel
Chicago and North Western
Transportation Company
400 West Madison Street
Chicago, Illinois 60606

(l) Exhibit A is a sketch map depicting both applicant's existing lines together with the proposed line. Exhibit B attached to this application shows the proposed line together with existing highway lines, villages, towns and other required

information, and shows the limits of the joint track and the sole Burlington Northern track.

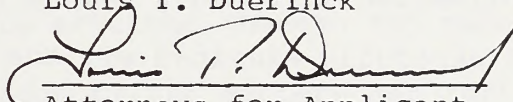
Respectfully submitted,

Anthony Kane
Frank S. Farrell
Richard M. Gleason



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176 East Fifth Street
St. Paul, Minnesota 55101

Richard M. Freeman
Louis T. Duerinck



Attorneys for Applicant
Chicago and North Western
Transportation Company
400 West Madison Street
Chicago, Illinois 60606

STATE OF MINNESOTA }
COUNTY OF RAMSEY } ss.

VERIFICATION

R. W. DOWNING makes oath and says that he is Vice Chairman - Chief Operating Officer of Burlington Northern Inc., applicant herein; that he has been authorized by proper corporate action on the part of said applicant, or by proper court, to verify and file with the Interstate Commerce Commission the foregoing application in Finance Docket No. _____; that he has carefully examined all the statements referred to in said application and the exhibits attached thereto and made a part thereof; that he has knowledge of the matters set forth in such application and that all such statements made and matters set forth therein are true and correct to the best of his knowledge, information and belief.

R. W. Downing

R. W. Downing

Subscribed and sworn to before me
James H. McCarthy in and for the
State and County above named, this
30th day of January, 1974.

James H. McCarthy

Notary Public
My Commission Expires Jan. 5, 1975

COUNTY OF COOK)

VERIFICATION

knowledge, information, and belief.

Richard M. Freeman

Subscribed and sworn to before me

a Notary

Public in and for the State and

County this 3rd day of January, 1974

Albert R Zuspamm

My Commission Expires: AUG 15 1977

BEFORE THE
INTERSTATE COMMERCE COMMISSION

APPLICATION OF BURLINGTON NORTHERN)	
INC. AND CHICAGO AND NORTH WESTERN)	
TRANSPORTATION COMPANY PURSUANT TO)	FINANCE DOCKET NO.
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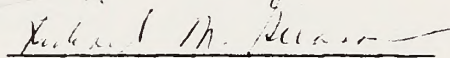
ENVIRONMENTAL IMPACT STATEMENT

Statement

North Western and Burlington Northern contend that the granting of the application is not a major federal action which will significantly affect the quality of the human environment within the meaning of the National Environmental Policy Act of 1969.

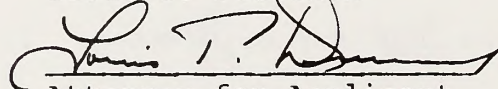
Respectfully submitted,

Richard M. Gleason

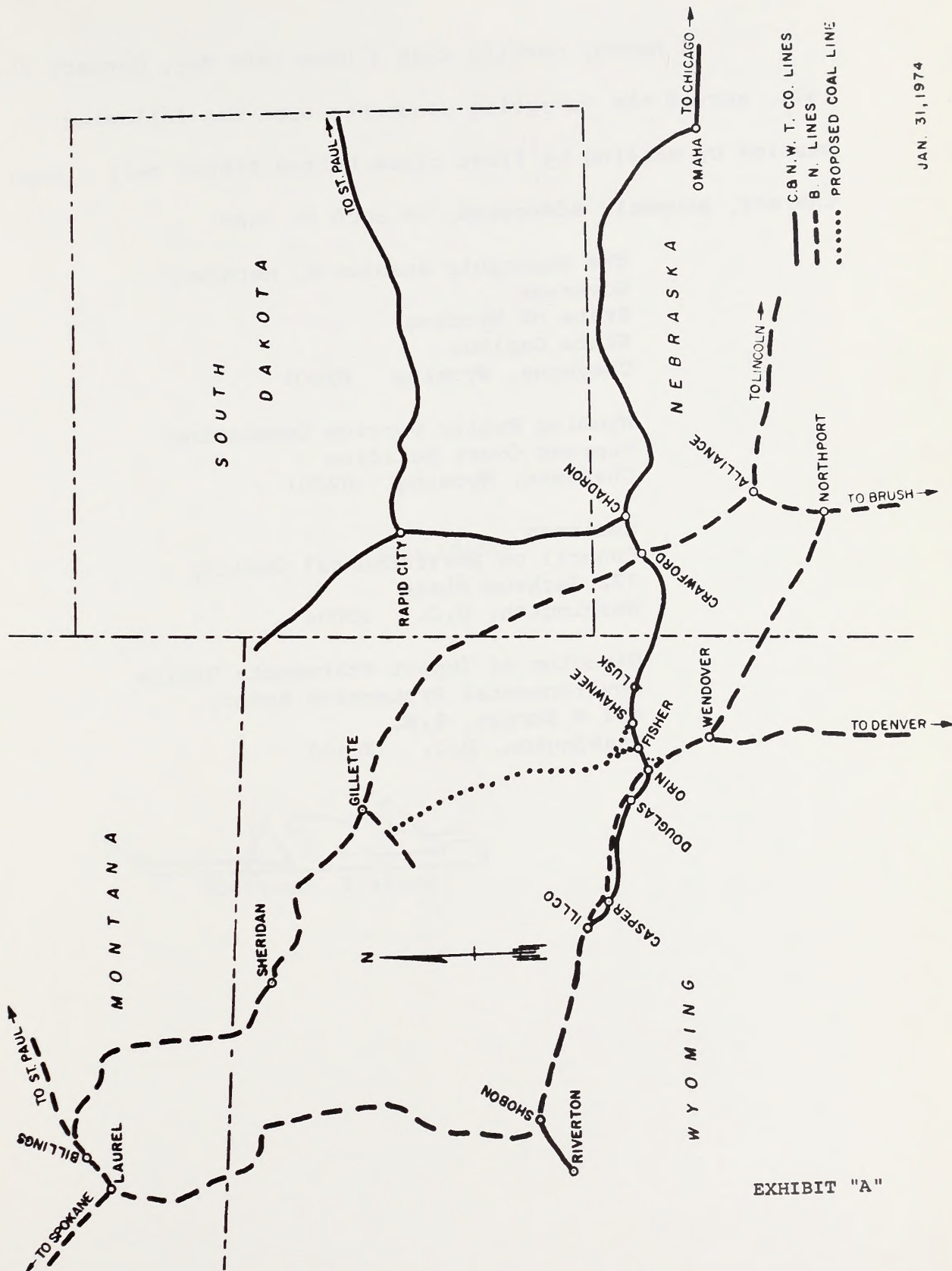


Attorney for Applicant
Burlington Northern Inc.
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St. Paul, Minnesota 55101

Louis T. Duerinck



Attorney for Applicant
Chicago and North Western
Transportation Company
400 West Madison Street
Chicago, Illinois 60606



JAN. 31, 1974

EXHIBIT "A"

CERTIFICATE OF SERVICE

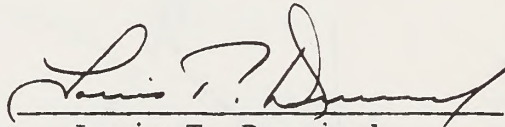
I hereby certify that I have this day, January 31, 1974, served the foregoing documents upon the following parties by mailing by first class United States mail a copy thereof, properly addressed, to each of them.

The Honorable Stanley K. Hathaway
Governor
State of Wyoming
State Capitol
Cheyenne, Wyoming 82001

Wyoming Public Service Commission
Supreme Court Building
Cheyenne, Wyoming 82001

Chairman
Council on Environmental Quality
722 Jackson Place
Washington, D.C. 20006

Director of Impact Statements Office
Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460


Louis T. Duerinck

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The above information is being furnished to you for your information and use.

Very truly yours,
John F. Kennedy
President of the United States

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COAL LEASES

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

COAL LEASE

Land Office

WYOMING

Serial Number

Wyoming 2313

(Unit 3 out of W-0321779)

This lease, entered into on the 1 day of December, 1966, by the United States of America, the lessor,

through the Bureau of Land Management, and Paul F. Faust
2806 S. St. Paul Street
Denver, Colorado 80210

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LAND OFFICE
CODY WYOMING

DEC 11 1966

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the lessee,
pursuant and subject to the terms and provisions of the Act of February 25, 1920 (41 Stat. 437), as amended, herein-
after referred to as the Act, and to all reasonable regulations of the Secretary of the Interior now or hereafter in force
which are made a part hereof,

AND pursuant and subject to the terms and provisions of the Acquired Lands Leasing
Act of August 7, 1947, (61 Stat. 913), et seq.,

WITNESSETH:

Sec. 1. *Rights of Lessee.* The lessor, in consideration of the rents and royalties to be paid and the conditions to be
observed as hereinafter set forth does hereby grant and lease to the lessee the exclusive right and privilege to mine
and dispose of all the coal in the following-described tracts of land, situated in the State of Wyoming

T. 42 N., R. 70 W., 6th Prin. Mer.,
Sec. 2: Lots 1, 2, 3, 4, S $\frac{1}{2}$ N $\frac{1}{2}$, N $\frac{1}{2}$ S $\frac{1}{2}$
Sec. 3: Lots 1, 2, 3, 4, S $\frac{1}{2}$ N $\frac{1}{2}$, N $\frac{1}{2}$ S $\frac{1}{2}$

T. 43 N., R. 70 W., 6th Prin. Mer.
Sec. 17: All
Sec. 20: All
Sec. 21: All
Sec. 22: W $\frac{1}{2}$ W $\frac{1}{2}$, SE $\frac{1}{4}$ SW $\frac{1}{4}$, SW $\frac{1}{4}$ SE $\frac{1}{4}$
Sec. 27: W $\frac{1}{2}$ E $\frac{1}{2}$, W $\frac{1}{2}$
Sec. 28: All
Sec. 29: NE $\frac{1}{4}$
Sec. 33: E $\frac{1}{2}$
Sec. 34: All
Sec. 35: W $\frac{1}{2}$, SE $\frac{1}{4}$

ACQUIRED LAND

T. 43 N., R. 70 W., 6th Prin. Mer.,
Sec. 22: NE $\frac{1}{4}$ SW $\frac{1}{4}$ 40 acres

containing 5,884.31 acres, more or less, together with the right to construct all such works, buildings, plants,
structures, and appliances as may be necessary and convenient for the mining and preparation of the coal for market,
the manufacture of coke or other products of coal, the housing and welfare of employees, and subject to the conditions
herein provided, to use so much of the surface as may reasonably be required in the exercise of the rights and privi-
leges herein granted.

Sec. 2. In consideration of the foregoing, the lessee hereby agrees:

(a) *Bond.* To maintain the bond furnished upon the issuance of this lease, which bond is conditioned upon compliance with all the provisions of the lease, and to increase the amount or furnish such other bond as may be required.

(b) *Rental.* To pay the lessor annually, in advance, for each acre or fraction thereof covered by this lease, beginning with the date hereof, the following rentals: 25 cents for the first year; 50 cents for the second, third, fourth, and fifth years, respectively; and \$1 for the sixth and each succeeding year during the continuance of the lease, such rental for any year to be credited against the first royalties as they accrue under the lease during the year for which the rental was paid.

(c) *Royalty.* To pay the lessor a royalty of cents on every ton of 2,000 pounds of coal mined during the first 20 years succeeding the execution of this lease. Royalties shall be payable quarterly within

30 days from the expiration of the quarter in which the coal is mined. For additional royalty terms see last page.

(d) *Minimum production.* Beginning with the sixth year of the lease, except when operations are interrupted by strikes, the elements, or casualties not attributable to the lessee, or unless on application and showing made, operations shall be suspended when market conditions are such that the lessee cannot operate except at a loss or suspended for the other reasons specified in Section 39 of the Act, to mine coal each year and pay a royalty thereon to a value of \$1 per acre or fraction thereof. Operations under this lease shall be continuous except in circumstances described or unless the lessee shall pay a royalty, less rent, on such minimum amount of the leased deposits, for one year in advance, in which case operations may be suspended for that year.

(e) *Payments.* To make rental payments to the Manager of the appropriate Land Office, except that when this lease becomes productive the rentals and

LAND OFFICE CODY

royalties shall be paid to the appropriate Regional Mining Supervisor of the United States Geological Survey, with whom all reports concerning operations under the lease shall be filed. All remittances to the Manager of the Land Office shall be made payable to the Bureau of Land Management, those to the Geological Survey shall be made payable to the United States Geological Survey.

(f) *Plats, reports, maps.* At such times and in such form as the lessor may prescribe, to furnish a plat showing development work and improvements on the leased lands and a report with respect to stockholders, investment, depreciation, and costs. To furnish in such form as the lessor may prescribe, within 30 days from the expiration of each quarter a report covering such quarter, certified by the superintendent of the mine, or by such other agent having personal knowledge of the facts as may be designated by the lessee for such purpose, showing the amount of leased deposits mined during the quarter, the character and quality thereof, amount of its products and byproducts disposed of and price received therefor, and amount in storage or held for sale. To keep and prepare maps of the leased lands in accordance with the appropriate regulations.

(g) *Weights.* To determine accurately the weight or quantity and quality of all leased deposits mined, and to enter accurately the weight or quantity and quality thereof in due form in books to be kept and preserved by the lessee for such purposes.

(h) *Inspection.* To permit at all reasonable times (1) inspection by any duly authorized officer of the Department, of the leased premises and all surface and underground improvements, works, machinery, equipment, and all books and records pertaining to operations and surveys or investigations under this lease; and (2) the lessor to make copies of and extracts from any or all books and records pertaining to operations under this lease, if desired.

(i) *Assignment.* To file for approval in the appropriate Land Office within 90 days from the date of execution, any assignment or transfer made of this lease, whether by direct assignment, operating agreement, working or royalty interest, or otherwise. Such instrument will take effect the first day of the month following its approval by the Bureau of Land Management, or if the assignee requests, the first day of the month of approval. The showing required to be made with an assignment or transfer is set forth in the appropriate regulations.

See attached WSO 1510-5

(j) *Nondiscrimination clauses.* During the performance of this contract the lessee agrees as follows:

(1) The lessee will not discriminate against any employee or applicant for employment because of race, creed, color, or national origin. The lessee will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, creed, color, or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The lessee agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause.

(2) The lessee will, in all solicitations or advertisements for employees placed by or on behalf of the lessee, state that all qualified applicants will receive consideration for employment without regard to race, creed, color, or national origin.

(3) The lessee will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the agency contracting officer, advising the said labor union or workers' representative of the lessee's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The lessee will comply with all provisions of Executive Order No. 10925 of March 6, 1961, as amended, and of the rules, regulations, and relevant orders of the President's Committee on Equal Employment Opportunity created thereby.

(5) The lessee will furnish all information and reports required by Executive Order No. 10925 of March 6, 1961, as amended, and by the rules, regulations, and orders of the said Committee, or pursuant thereto, and will permit access to his books, records, and accounts by the contracting agency and the Committee for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the lessee's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this lease may be cancelled, terminated, or suspended in whole or in part and the lessee may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order No. 10925 of March 6, 1961, as amended, and such other sanctions may be imposed and remedies invoked as provided in the said Executive Order or by rule, regulation, or order of the President's Committee on Equal Employment Opportunity, or as otherwise provided by law.

(7) The lessee will include the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the President's Committee on Equal Employment Opportunity issued pursuant to Section 303 of Executive Order No. 10925 of March 6, 1961, as amended, so that such provisions will be binding upon each subcontractor or vendor. The lessee will take such action with respect to any subcontract or purchase order as the contracting agency may direct as a means of enforcing such provisions, including sanctions for noncompliance: *Provided, however,* that in the event the lessee becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the contracting agency, the lessee may request the United States to enter into such litigation to protect the interests of the United States.

(k) *Land disposed of with coal deposits reserved to the United States.* If the lands embraced herein have been or shall hereafter be disposed of under laws reserving to the United States the deposits of coal therein, to comply with all conditions as are or may hereafter be provided by the laws and regulations reserving such coal.

(l) *Operations, wages, freedom of purchase.* To comply with the appropriate operating regulations, to exercise reasonable diligence, skill, and care in the operations of the property, and to carry on all operations in accordance with approved methods and practices as provided in the operating regulations, having due regard for the prevention of injury to life, health or property, and of waste or damage to any water or mineral deposits; to fairly and justly weigh or measure the coal mined by each miner, to pay all wages due miners and employees, both above and below ground, at least twice each month in lawful money of the United States; to accord all miners and employees complete freedom of purchase; to restrict the workday to not exceeding eight hours in any one day for underground

workers, except in cases of emergency; to employ no boy under the age of sixteen and no girl or woman, without regard to age, in any mine below the surface; unless the laws of the State otherwise provide, in which case the State laws control.

(m) *Taxes.* To pay when due, all taxes lawfully assessed and levied under the laws of the State or the United States upon improvements, output of mines, or other rights, property, or assets of the lessee.

(n) *Overriding royalties.* Not to create, by assignment or otherwise, an overriding royalty interest in excess of 50 percent of the rate of royalty first payable to the United States under this lease or an overriding royalty interest which when added to any other outstanding overriding royalty interest exceeds that percentage, excepting, that where an interest in the leasehold or in an operating agreement is assigned, the assignor may retain an overriding royalty interest in excess of the above limitation if he shows to the satisfaction of the Bureau of Land Management, that he has made substantial investments for improvements on the land covered by the assignment.

(o) *Delivery of premises in case of forfeiture.* In case of forfeiture of this lease, to deliver up to the lessor in good order and condition the land leased, including all buildings, and underground timbering and such other supports and structures as are necessary for the preservation of the mine or deposit.

Sec. 3. The lessor expressly reserves:

(a) *Rights reserved.* The right to permit for joint or several use such easements or rights-of-way, including easements in tunnels upon, through, or in the land leased, occupied, or used as may be necessary or appropriate to the working of the same or other lands containing the deposits described in the Act, and the treatment and shipment of the products thereof by or under authority of the Government, its lessees or permittees, and for other public purposes.

(b) *Disposition of surface.* The right to lease, sell, or otherwise dispose of the surface of the leased lands under existing law or laws hereafter enacted, insofar as said surface is not necessary for the use of the lessee in the extraction and removal of the coal therein, or to dispose of any resource in such lands which will not unreasonably interfere with operations under this lease.

(c) *Monopoly and fair prices.* Full power and authority to promulgate and enforce all the provisions of Section 30 of the Act to insure the sale of the production of said leased lands to the United States and to the public at reasonable prices, to prevent monopoly, and to safeguard the public welfare.

(d) *Readjustment of terms.* The right reasonably to readjust and fix royalties payable hereunder and other terms and conditions at the end of 20 years from the date hereof and thereafter at the end of each succeeding 20-year period during the continuance of this lease unless otherwise provided by law at the time of the expiration of any such period. Unless the lessee files objections to the proposed terms or a relinquishment of the lease within 30 days after receipt of the notice of proposed terms for a 20-year period, he will be deemed to have agreed to such terms.

(e) *Waiver of conditions.* The right to waive any breach of the conditions contained herein, except the breach of such conditions as are required by the Act, but any such waiver shall extend only to the particular breach so waived and shall not limit the rights of the

lessor with respect to any future breach; nor shall the waiver of a particular cause of forfeiture prevent cancellation of this lease for any other cause, or for the same cause occurring at another time.

Sec. 4. *Relinquishment of lease.* Upon a satisfactory showing that the public interest will not be impaired, the lessee may surrender the entire lease or any legal subdivision thereof. A relinquishment *must* be filed in duplicate in the appropriate Land Office. Upon its acceptance it shall be effective as of the date it is filed, subject to the continued obligation of the lessee and his surety to make payment of all accrued rentals and royalties and to provide for the preservation of any mines or productive works or permanent improvements on the leased lands in accordance with the regulations and terms of the lease.

Sec. 5. *Protection of the surface, natural resources, and improvements.* The lessee agrees to take such reasonable steps as may be needed to prevent operations from unnecessarily: (1) causing or contributing to soil erosion or damaging any forage and timber growth thereon; (2) polluting the waters of springs, streams, wells, or reservoirs; (3) damaging crops, including forage, timber, or improvements of a surface owner; or (4) damaging range improvements whether owned by the United States or by its grazing permittees or lessees; and upon any partial or total relinquishment or the cancellation or expiration of this lease, or at any other time prior thereto when required by the lessor and to the extent deemed necessary by the lessor, to fill any sump holes, ditches and other excavations, remove or cover all debris, and, so far as reasonably possible, restore the surface of the leased land to its former condition, including the removal of structures as and if required. The lessor may prescribe the steps to be taken and restoration to be made with respect to lands of the United States and improvements thereon.

Sec. 6. *Removal of equipment, etc., on termination of lease.* Upon termination of this lease, by surrender or forfeiture, the lessee shall have the privilege at any time within a period of 90 days thereafter of removing from the premises all machinery, equipment, tools and materials, except underground timbering placed by the lessee in or on the leased lands, which are necessary for the preservation of the mine. Any materials, tools, appliances, machinery, structures, and equipment, subject to removal as above provided, which are allowed to remain on the leased lands shall become the property of the lessor on expiration of the 90-day period or such extension thereof as may be granted because of adverse climatic conditions, but the lessee shall remove any or all of such property where so directed by the lessor.

Sec. 7. *Proceedings in case of default.* If the lessee shall not comply with any of the provisions of the Act or the regulations thereunder or default in the performance or observance of any of the provisions of this lease, and such default shall continue for a period of 30 days after service of written notice thereof by the lessor, the lessor may institute appropriate proceedings in a court of competent jurisdiction for the forfeiture and cancellation of this lease as provided in Section 31 of the Act. If the lessee fails to take prompt and necessary steps to prevent loss or damage to the mine, property, or premises, or danger to the employees, the lessor may enter on the premises and take such measures as may be deemed necessary to prevent such loss or damage or to correct the dangerous or unsafe condition of the mine or works thereof, which shall be at the expense of the lessee. However, the lessee shall


not be held responsible for delays or casualties occasioned by causes beyond the lessee's control.

Sec. 8. *Heirs and successors in interest.* Each obligation hereunder shall extend to, and be binding upon, and every benefit hereof shall inure to, the heirs, executors, administrators, successors, or assigns of the respective parties hereto.

Sec. 9. *Unlawful interest.* No Member of, or Delegate to, Congress, or Resident Commissioner, after his

election or appointment, or either before or after he has qualified and during his continuance in office, and no officer, agent, or employee of the Department of the Interior, except as provided in 43 CFR 7.4(a)(1), shall be admitted to any share or part in this lease or derive any benefit that may arise therefrom; and the provisions of Section 3741 of the Revised Statutes of the United States, as amended (41 U.S.C. Sec. 22), and Sections 431, 432, and 433, Title 18, U.S.C., relating to contracts, enter into and form a part of this lease so far as the same may be applicable.

THE UNITED STATES OF AMERICA

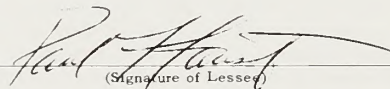
By 
(Signing Officer)
George S. Neuberg
Assistant Manager, Mining

(Title)

WITNESS TO SIGNATURE OF LESSEE

November 21, 1966

(Date)


(Signature of Lessee)

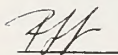
(Signature of Lessee)

(Signature of Lessee)

(If this lease is executed by a corporation, it must bear the corporate seal)

(c) Royalty

To pay the lessor a royalty of 17½ cents a ton of 2,000 pounds for coal mined for the first 10 years of the lease and 20 cents a ton for the remainder of the first 20-year period succeeding the execution of this lease.


Initial

10,000
St Paul, Fire & Marine
Robert M. Lewis
655 Broadway Bldg.
Denver, Colo. 80203

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

STIPULATION FOR LANDS UNDER JURISDICTION OF DEPARTMENT OF AGRICULTURE *

The lands embraced in this lease or permit being under the jurisdiction of the Secretary of Agriculture, the lessee or permittee hereby agrees:

(1) To conduct all operations authorized by this lease or permit with due regard for good land management, not to cut or destroy timber without first obtaining permission from the authorized representative of the Secretary of Agriculture, and to pay for all such timber cut or destroyed at the rates prescribed by such representative; to avoid unnecessary damage to improvements, timber, crops, or other cover; unless otherwise authorized by the Secretary of Agriculture, not to drill any well, carry on operations, make excavations, construct tunnels, drill, or otherwise disturb the surface of the lands within 200 feet of any building standing on the lands and whenever required, in writing, by the authorized representative of the Secretary of Agriculture to fence or fill all sump holes, ditches, and other excavations, remove or cover all debris, and so far as reasonably possible, restore the surface of the lands to their former condition, including the removal of structures as and if required, and when required by such representative to bury all pipelines below plow depth.

(2) To do all in his power to prevent and suppress forest, brush, or grass fires on the lands and in their vicinity, and to require his employees, contractors, subcontractors, and employees of contractors or subcontractors to do likewise. Unless prevented by circumstances over which he has no control, the lessee or permittee shall place his employees, contractors, subcontractors, and employees of contractors and subcontractors employed on the lands at the disposal of any authorized officer of the Department of Agriculture for the purpose of fighting forest, brush, or grass fires on or originating on the lands or on adjacent areas or caused by the negligence of the lessee or permittee or his employees, contractors, subcontractors and employees of contractors and subcontractors, with the understanding that payment for such services shall be made at rates to be determined by the authorized representative of the Secretary of

Agriculture, which rates shall not be less than the current rates of pay prevailing in the vicinity for services of a similar character. *Provided*, that if the lessee or permittee, his employees, contractors, subcontractors, or employees of contractors or subcontractors, caused or could have prevented the origin or spread of said fire or fires, no payment shall be made for services so rendered.

During periods of serious fire danger to forest, brush, or grass, as may be specified by the authorized representative of the Secretary of Agriculture, the lessee or permittee shall prohibit smoking and the building of camp and lunch fires by his employees, contractors, subcontractors, and employees of contractors or subcontractors within the area involved except at established camps, and shall enforce this prohibition by all means within his power: *Provided*, that the authorized representative of the Secretary of Agriculture may designate safe places where, after all inflammable material has been cleared away, campfires may be built for the purpose of heating lunches and where, at the option of the lessee or permittee, smoking may be permitted.

The lessee or permittee shall not burn rubbish, trash, or other inflammable materials *except* with the consent of the authorized representative of the Secretary of Agriculture and shall not use explosives in such a manner as to scatter inflammable materials on the surface of the lands during the forest, brush, or grass fire season, *except* as authorized to do so or on areas approved by such representative.

The lessee or permittee shall build or construct such fire lines or do such clearing on the lands as the authorized representative of the Secretary of Agriculture decides is essential for forest, brush, and grass fire prevention which is or may be necessitated by the

* This form of stipulation may be used in connection with leases and permits issued under the Acts of February 25, 1920, as amended (30 U.S.C. 181 *et seq.*); August 7, 1947 (30 U.S.C. 351 *et seq.*); February 7, 1927, as amended (30 U.S.C. 281 *et seq.*); April 17, 1926, as amended (30 U.S.C. 271 *et seq.*); October 20, 1914, as

amended (48 U.S.C. 432 *et seq.*); June 28, 1944 (58 Stat 463 *et seq.*); September 1, 1949 (30 U.S.C. 192c); June 30, 1950 (16 U.S.C. 508b); or under the authority of any of the Acts cited in Section 402 of the President's Reorganization Plan No. 3 of 1946 (5 U.S.C. 133y-16, Note).

exercise of the privileges authorized by this lease or permit, and shall maintain such fire tools at his headquarters or at the appropriate location on the lands as are deemed necessary by such representative.

(3) In the location, design, construction and maintenance of all authorized works, buildings, plants, waterways, roads, telegraph or telephone lines, pipelines, reservoirs, tanks, pumping stations, or other structures or clearance, the lessee or permittee shall do all things reasonably necessary to prevent or reduce to the fullest extent scarring and erosion of the lands, pollution of the water resources and any damage to the watershed. Where construction, operation, or maintenance of any of the facilities on or connected with this lease or permit causes damage to the watershed or pollution of the water resources, the lessee or permittee agrees to repair such damage and to take such corrective measures to prevent further pollution or damage to the watershed as are deemed necessary by the authorized representative of the Secretary of Agriculture.

(4) To pay the lessor or permitter or his tenant or the surface owner or his tenant, as the case may be, for any and all damage to or destruction of property caused by the lessee's or permittee's operations hereunder; to save and hold the lessor or permitter or the surface owner or their tenants harmless from all damage or claims for damage to persons or property resulting from the lessee's or permittee's operations under this lease or permit.

(5) To recognize existing uses and commitments, in the form of Department of Agriculture grazing, timber cutting, and special use permits, water developments, ditch, road, trail, pipeline, telephone line, and fence rights-of-way and other similar improvements, and to conduct his operations so as to interfere as little as possible with the rights and privileges granted by these permits or with other existing uses.

(6) To install and maintain cattle guards to prevent the passage of livestock in any openings made in fences by the lessee or permittee or his contractors to provide access to the lands covered by this lease or permit for automotive and other equipment.

(7) If lessee or permittee shall construct any camp on the lands, such camp shall be located at a place approved by the authorized representative of the Secretary of Agriculture, and such representative shall have authority to require that such camp be kept in in a neat and sanitary condition.

(8) To comply with all the rules and regulations of the Secretary of Agriculture governing the national forests or other lands under his jurisdiction which are embraced in this lease or permit.

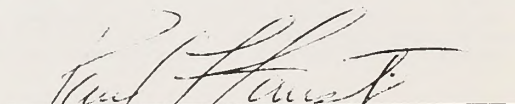
(9) Unless otherwise authorized, prior to the beginning of operations to appoint and maintain at all times during the term of this lease or permit a local agent upon whom may be served written orders or notices respecting matters contained in this stipulation, and to inform the authorized representative of the Secretary of Agriculture, in writing, of the name and address of such agent. If a substitute agent is appointed, the lessee or permittee shall immediately so inform the said representative.

(10) To address all matters relating to this stipulation to
District Ranger

at
213 North Second
Douglas, Wyoming 82633

who is the authorized representative of the Secretary of Agriculture, or to such other representative as may from time to time, be designated, provided that such designation shall be in writing and be delivered to the lessee or permittee or his agent.

(11) If all or any part of the lands lie within a municipal watershed, or are, in the opinion of the authorized representative of the Secretary of Agriculture, primarily valuable for watershed protection, the lessee or permittee shall reseed or otherwise restore the vegetative cover, as required by the authorized representative of the Secretary of Agriculture, for watershed protection and erosion prevention on any areas damaged because of the operation.


(Signature of Lessee)

SUPPLEMENTAL STIPULATION TO
STIPULATION FOR LANDS UNDER JURISDICTION OF DEPARTMENT OF AGRICULTURE

To be attached to and made a part of Form 3103-2.

A. Applicable to Exploration Activities

- 1 At least two weeks before beginning any exploration work, including access and work road location and construction, the lessee shall prepare a "Lessee Exploration Plan" with the District Ranger of Thunder Basin National Grasslands, Douglas, Wyoming. The plan shall be prepared in triplicate, including maps, for approval by the Forest Supervisor. Such approval will be conditioned on reasonable requirements needed to prevent soil erosion, water pollution, and unnecessary damages to the surface vegetation and other resources of the United States and to provide for the restoration of the land surface and vegetation. The plan shall contain all such provisions as the Forest Service may deem necessary to maintain proper management of the lands and resources within the exploration area.

Where appropriate, depending upon the location and type of operation, the Forest Supervisor may require the plan to contain, at a minimum, the following items:

- (a) The location, construction specifications, maintenance program, and estimated use by the lessee, his employees and agents, of all access and work roads.
- (b) The location and extent of any and all areas to be occupied during the explorations.
- (c) The methods to be used in the explorations, including disposal of waste material.
- (d) The size and type of equipment to be used in the explorations.
- (e) The capacity, size, character, standards of construction and location of all structures and facilities to be constructed.
- (f) Typical profiles of cuts and fills of all areas to be graded for the installation of structures and facilities.
- (g) The location and size of areas upon which vegetation will be destroyed and/or soil laid bare and the steps which will be taken to prevent and control soil erosion thereon, including but not limited to the proposed program for rehabilitation and revegetation of these disturbed lands both during and upon cessation of explorations.
- (h) The steps which will be taken to prevent water pollution.

- (i) The character, amount, and time of use of explosives or fire, including safety precautions which will be taken during their use.
- (j) The coordination and rehabilitation measures that will be taken to protect other uses of the land, permitted livestock, and wildlife.

If later explorations require departure from or additions to the approved plan, these revisions or amendments, together with justification statement for proposed revisions, will be submitted to the District Ranger for approval of the Forest Supervisor.

Any and all operations conducted in advance of approval of an original, revised, or amended exploration plan, or which are not in accord with an approved plan, constitute a violation of the terms of this lease and the Forest Service reserves the right to close down explorations until such corrective action, as is deemed necessary, is taken by the lessee.

2. To guarantee the successful rehabilitation and revegetation of abandoned exploration sites, roads and other disturbed areas, as provided for in the "Lessee Exploration Plan," paragraph (1) above, the lessee will furnish the Forest Service a surety bond in the amount of Ten Thousand and No/100 Dollars (\$10,000.00) prior to undertaking any work on the lease area. Provided that, in the event the work is conducted in separate phases, each phase will be covered by a separate bond in the minimum amount of Ten Thousand and No/100 Dollars (\$10,000.00) before the start of any work on each phase. In lieu of surety bond, the lessee may deposit into a Federal Depository cash, through the Unit Collection Officer, Medicine Bow National Forest, or negotiable securities through the Regional Fiscal Agent, U. S. Forest Service, Bldg. 85, Denver Federal Center, Denver, Colorado 80225 in the amounts stated above or each separately bonded phase area. As soon as the lease area has been successfully rehabilitated and revegetated and approved in writing by the Forest Supervisor, surety will be notified, or cash deposits returned without interest, or securities returned without interest. The lessee agrees that all monies or deposits in lieu thereof, deposited under this authority may be retained by the United States to cover the cost of any said restoration and rehabilitation rendered necessary by failure of the lessee to fulfill all and singular the requirements assumed hereunder without prejudice whatever to any other rights and remedies of the United States.
3. No occupancy of the surface of the following areas is authorized by this lease. The lessee is, however, authorized to employ directional drilling to explore the mineral resources under these areas provided that such drilling or other works will not disturb the surface area or otherwise interfere with their use by the Forest Service. It is understood and agreed that the use of these areas for National Forest purposes is superior to any other use. The excluded areas are:

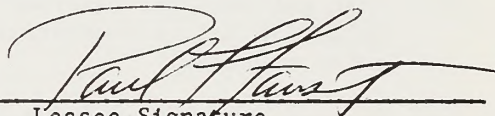
- (a) Within the normal highwater line of any and all lakes, ponds, and reservoirs located within the lease area.
- (b) Within 200 feet of the normal highwater line of any and all live streams in the area.
- (c) Within 400 feet of any and all springs and wells within the lease area.
- (d) Within 400 feet of any improvements either owned, permitted, leased or otherwise authorized by the Forest Service.

The distances in subparagraphs (a), (b), (c), and (d), may be reduced when specifically agreed to in the exploration plan, and paragraph (1).

B. Applicable to Production (operation) Activities

1. The lessee, before the start of any mining operations, agrees to enter into such additional specific stipulations with the Forest Service covering the lessee's mining operations as are deemed necessary and appropriate, depending upon the mining methods to be used and current mining and restoration technology, to meet the following land management principles:
 - (a) Maintain and protect the areas which will be either directly or indirectly affected by the lessee's mining operations to minimize the effect on grazing capabilities.
 - (b) Install structures and facilities and revegetate disturbed areas to protect the soil from excessive erosion and return the land to a usable condition.
 - (c) Take all measures reasonably necessary to minimize the pollution and contamination of the surface and subsurface water sources.
 - (d) Protect, insofar as is practicable, improvements owned or authorized by the Forest Service, and restore or replace these said improvements in event they must be destroyed or disturbed by the lessee's mining operations.
2. The lessee shall prepare in triplicate and submit an annual operating plan to the Forest Supervisor which will include as a minimum:
 - (a) The mining operating areas and the methods of operation planned for each area.
 - (b) The areas to be treated and details of the rehabilitation and revegetation measures to be initiated in the planning year to meet the stipulated requirements of the Forest Service.

- (c) The location and construction specifications of all roads necessary for the mining operation during the planning year.
 - (d) The steps to be taken to minimize water pollution and soil erosion.
 - (e) The correlation of the mining operations with the Forest Service's use and management of the lands not included in that year's operating plan.
3. The lessee shall submit to the Forest Supervisor an annual progress map and report of mining, restoration, and revegetation operations.
 4. The lessee shall furnish performance bonds as required by the Forest Supervisor to guarantee fulfillment of the stipulations, entered under (1) above, and the operating plans, prepared under (2) above.
 5. The Forest Service reserves the right to amend, alter, or otherwise change during the life of the lease, any and all stipulations necessary to meet the land management principles outlined in paragraph (1) above provided that before any such amendments, alterations, and other changes are made, the lessee shall be invited to make any comments as he may deem necessary and, provided further, that no such amendments, alterations, and changes in these stipulations shall be made unless agreed to in writing by the lessee and the Forest Service.
 6. The Forest Service reserves the right to manage and use all lands administered by it which are embraced within the lease for such purposes as they may deem desirable, provided, that this use and management shall not interfere or conflict with the current mining operations of the lessee.



Lessee Signature

WSO 1510-5
(Dec. '65)

EQUAL OPPORTUNITY

Non-discrimination clauses, regarding "Equal Opportunity", in the attached permit/lease are amended by deleting references to the President's Committee on Equal Employment Opportunity, Executive Order No. 10925 of March 6, 1961, as amended, and Section 303 of Executive Order No. 10925 of March 6, 1961, as amended; and substituting therefor the Secretary of Labor, Executive Order No. 11246 of September 24, 1965, and Section 204 of Executive Order No. 11246 of September 24, 1965, respectively.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

COAL LEASE

Land Office Serial Number

WYOMING

W-5036

This lease, entered into on **DEC 1 - 1967**, by the United States of America, the lessor,

through the Bureau of Land Management, and **Humble Oil & Refining Company**
P. O. Box 2180
Houston, Texas 77001

the lessee,
pursuant and subject to the terms and provisions of the Act of February 25, 1920 (41 Stat. 437) as amended, hereinafter referred to as the Act, and to all reasonable regulations of the Secretary of the Interior now or hereafter in force which are made a part hereof,

WITNESSETH:

Sec. 1. *Rights of Lessee.* The lessor, in consideration of the rents and royalties to be paid and the conditions to be observed as hereinafter set forth does hereby grant and lease to the lessee the exclusive right and privilege to mine and dispose of all the coal in the following-described tracts of land, situated in the State of **Wyoming**

T. 51 N., R. 72 W., 6th Prin. Mer.
Sec. 3: $S\frac{1}{2}NW\frac{1}{4}, SW\frac{1}{4}$
Sec. 4: All
Sec. 5: $S\frac{1}{2}N\frac{1}{2}, S\frac{1}{2}$
Sec. 6: Lots 1, 2, 3, 4, 5, 6, 7, $SE\frac{1}{4}NE\frac{1}{4}, SE\frac{1}{4}NW\frac{1}{4}, E\frac{1}{2}SW\frac{1}{4}, SE\frac{1}{4}$
Sec. 9: All
Sec. 10: All
Sec. 11: All
Sec. 14: All
Sec. 15: $N\frac{1}{2}, N\frac{1}{2}S\frac{1}{2}$
T. 52 N., R. 72 W., 6th Prin. Mer.
Sec. 31: $S\frac{1}{2}SE\frac{1}{4}$
Sec. 33: $W\frac{1}{2}, W\frac{1}{2}SE\frac{1}{4}$

containing **5,457.47** acres, more or less, together with the right to construct all such works, buildings, plants, structures, and appliances as may be necessary and convenient for the mining and preparation of the coal for market, the manufacture of coke or other products of coal, the housing and welfare of employees, and subject to the conditions herein provided, to use so much of the surface as may reasonably be required in the exercise of the rights and privileges herein granted.

Sec. 2. In consideration of the foregoing, the lessee hereby agrees:

(a) *Bond.* To maintain the bond furnished upon the issuance of this lease, which bond is conditioned upon compliance with all the provisions of the lease, and to increase the amount or furnish such other bond as may be required.

(b) *Rental.* To pay the lessor annually, in advance, for each acre or fraction thereof covered by this lease, beginning with the date hereof, the following rentals: 25 cents for the first year; 50 cents for the second, third, fourth, and fifth years, respectively; and \$1 for the sixth and each succeeding year during the continuance of the lease, such rental for any year to be credited against the first royalties as they accrue under the lease during the year for which the rental was paid.

(c) *Royalty.* To pay the lessor a royalty of cents on every ton of 2,000 pounds of coal mined during the first 20 years succeeding the execution of this lease. Royalties shall be payable quarterly within

30 days from the expiration of the quarter in which the coal is mined. **For additional royalty terms see last page.**

(d) *Minimum production.* Beginning with the sixth year of the lease, *except* when operations are interrupted by strikes, the elements, or casualties not attributable to the lessee, or unless on application and showing made, operations shall be suspended when market conditions are such that the lessee cannot operate *except* at a loss or suspended for the other reasons specified in Section 39 of the Act, to mine coal each year and pay a royalty thereon to a value of \$1 per acre or fraction thereof. Operations under this lease shall be continuous *except* in circumstances described or unless the lessee shall pay a royalty, less rent, on such minimum amount of the leased deposits, for one year in advance, in which case operations may be suspended for that year.

(e) *Payments.* To make rental payments to the Manager of the appropriate Land Office, *except* that when this lease becomes productive the rentals and

ORIGINAL

royalties shall be paid to the appropriate regional mining supervisor of the United States Geological Survey, with whom all reports concerning operations under the lease shall be filed. All remittances to the manager of the land office shall be made payable to the Bureau of Land Management, those to the Geological Survey shall be made payable to the United States Geological Survey.

(f) *Plats, reports, maps.* At such times and in such form as the lessor may prescribe, to furnish a plat showing development work and improvements on the leased lands and a report with respect to stockholders, investment, depreciation, and costs. To furnish in such form as the lessor may prescribe, within 30 days from the expiration of each quarter a report covering such quarter, certified by the superintendent of the mine, or by such other agent having personal knowledge of the facts as may be designated by the lessee for such purpose, showing the amount of leased deposits mined during the quarter, the character and quality thereof, amount of its products and byproducts disposed of and price received therefor, and amount in storage or held for sale. To keep and prepare maps of the leased lands in accordance with the appropriate regulations.

(g) *Weights.* To determine accurately the weight or quantity and quality of all leased deposits mined, and to enter accurately the weight or quantity and quality thereof in due form in books to be kept and preserved by the lessee for such purposes.

(h) *Inspection.* To permit at all reasonable times (1) inspection by any duly authorized officer of the Department, of the leased premises and all surface and underground improvements, works, machinery, equipment, and all books and records pertaining to operations and surveys or investigations under this lease; and (2) the lessor to make copies of and extracts from any or all books and records pertaining to operations under this lease, if desired.

(i) *Assignment.* To file for approval in the appropriate land office within 90 days from the date of execution, any assignment or transfer made of this lease, whether by direct assignment, operating agreement, working or royalty interest, or otherwise. Such instrument will take effect the first day of the month following its approval by the Bureau of Land Management, or if the assignee requests, the first day of the month of approval. The showing required to be made with an assignment or transfer is set forth in the appropriate regulations.

(j) *Equal Opportunity clause.* During the performance of this contract the lessee agrees as follows:

(1) The lessee will not discriminate against any employee or applicant for employment because of race, creed, color, or national origin. The lessee will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, creed, color, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The lessee agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause.

(2) The lessee will, in all solicitations or advertisements for employees placed by or on behalf of the lessee, state that all qualified applicants will receive consideration for employment without regard to race, creed, color, or national origin.

(3) The lessee will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the agency contracting officer, advising the labor union or workers' representative of the lessee's commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The lessee will comply with all provisions of Executive Order No. 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(5) The lessee will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the lessee's noncompliance with the nondiscrimination clauses of this contract or with any of such rules, regulations, or orders, this contract may be cancelled, terminated or suspended in whole or in part and the lessee may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The lessee will include the provisions of Paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The lessee will take such action with respect to any subcontract or purchase order as the contracting agency may direct as a means of enforcing such provisions including sanctions for noncompliance: *Provided, however,* That in the event the lessee becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the contracting agency, the lessee may request the United States to enter into such litigation to protect the interest of the United States.

(k) *Land disposed of with coal deposits reserved to the United States.* If the lands embraced herein have been or shall hereafter be disposed of under laws reserving to the United States the deposits of coal therein, to comply with all conditions as are or may hereafter be provided by the laws and regulations reserving such coal.

(l) *Operations, wages, freedom of purchase.* To comply with the appropriate operating regulations, to exercise reasonable diligence, skill, and care in the operations of the property, and to carry on all operations in accordance with approved methods and practices as provided in the operating regulations, having due regard for the prevention of injury to life, health or property, and of waste or damage to any water or mineral deposits; to fairly and justly weigh or measure the coal mined by each miner, to pay all wages due miners and employees, both above and below ground, at least twice each month in lawful money of the United States; to accord all miners and employees complete freedom of purchase; to restrict the workday to not exceeding eight hours in any one day for underground

workers, except in cases of emergency to employ no boy under the age of sixteen and no girl or woman, without regard to age, in any mine below the surface; unless the laws of the State otherwise provide, in which case the State laws control.

(m) *Taxes.* To pay when due, all taxes lawfully assessed and levied under the laws of the State or the United States upon improvements, output of mines, or other rights, property, or assets of the lessee.

(n) *Overriding royalties.* Not to create, by assignment or otherwise, an overriding royalty interest in excess of 50 percent of the rate of royalty first payable to the United States under this lease or an overriding royalty interest which when added to any other outstanding overriding royalty interest exceeds that percentage, excepting, that where an interest in the leasehold or in an operating agreement is assigned, the assignor may retain an overriding royalty interest in excess of the above limitation if he shows to the satisfaction of the Bureau of Land Management, that he has made substantial investments for improvements on the land covered by the assignment.

(o) *Delivery of premises in case of forfeiture.* In case of forfeiture of this lease, to deliver up to the lessor in good order and condition the land leased, including all buildings, and underground timbering and such other supports and structures as are necessary for the preservation of the mine or deposit.

Sec. 3. The lessor expressly reserves:

(a) *Rights reserved.* The right to permit for joint or several use such easements or rights-of-way, including easements in tunnels upon, through, or in the land leased, occupied, or used as may be necessary or appropriate to the working of the same or other lands containing the deposits described in the act, and the treatment and shipment of the products thereof by or under authority of the Government, its lessees or permittees, and for other public purposes.

(b) *Disposition of surface.* The right to lease, sell, or otherwise dispose of the surface of the leased lands under existing law or laws hereafter enacted, insofar as said surface is not necessary for the use of the lessee in the extraction and removal of the coal therein, or to dispose of any resource in such lands which will not unreasonably interfere with operations under this lease.

(c) *Monopoly and fair prices.* Full power and authority to promulgate and enforce all the provisions of section 30 of the act to insure the sale of the production of said leased lands to the United States and to the public at reasonable prices, to prevent monopoly, and to safeguard the public welfare.

(d) *Readjustment of terms.* The right reasonably to readjust and fix royalties payable hereunder and other terms and conditions at the end of 20 years from the date hereof and thereafter at the end of each succeeding 20-year period during the continuance of this lease unless otherwise provided by law at the time of the expiration of any such period. Unless the lessee files objections to the proposed terms or a relinquishment of the lease within 30 days after receipt of the notice of proposed terms for a 20-year period, he will be deemed to have agreed to such terms.

(e) *Waiver of conditions.* The right to waive any breach of the conditions contained herein, except the breach of such conditions as are required by the act, but any such waiver shall extend only to the particular breach so waived and shall not limit the rights of the

lessor with respect to any future breach, nor shall the waiver of a particular cause of forfeiture prevent cancellation of this lease for any other cause, or for the same cause occurring at another time.

Sec. 4. *Relinquishment of lease.* Upon a satisfactory showing that the public interest will not be impaired, the lessee may surrender the entire lease or any legal subdivision thereof. A relinquishment must be filed in duplicate in the appropriate land office. Upon its acceptance it shall be effective as of the date it is filed, subject to the continued obligation of the lessee and his surety to make payment of all accrued rentals and royalties and to provide for the preservation of any mines or productive works or permanent improvements on the leased lands in accordance with the regulations and terms of the lease.

Sec. 5. *Protection of the surface, natural resources, and improvements.* The lessee agrees to take such reasonable steps as may be needed to prevent operations, including operation of operating plants on the leased premises, from unnecessarily: (1) causing or contributing to soil erosion or damaging any forage and timber growth on the leased lands or on Federal or non-Federal lands in the vicinity; (2) polluting air and water; (3) damaging crops, including forage, timber, or improvements of a surface owner; (4) damaging improvements whether owned by the United States or by its permittees or lessees; or (5) destroying, damaging, or removing fossils, historic or prehistoric ruins, or artifacts; and upon any partial or total relinquishment or the cancellation or expiration of this lease, or at any other time prior thereto when required and to the extent deemed necessary by the lessor to fill any sump holes, ditches, and other excavations, remove or cover all debris, and, so far as reasonably possible, restore the surface of the leased land and access roads to its former condition, including the removal of structures as and if required. The lessor may prescribe the steps to be taken and restoration to be made with respect to the leased lands and improvements thereon, whether or not owned by the United States.

Sec. 6. *Removal of equipment, etc., on termination of lease.* Upon termination of this lease, by surrender or forfeiture, the lessee shall have the privilege at any time within a period of 90 days thereafter of removing from the premises all machinery, equipment, tools and materials, except underground timbering placed by the lessee in or on the leased lands, which are necessary for the preservation of the mine. Any materials, tools, appliances, machinery, structures, and equipment, subject to removal as above provided, which are allowed to remain on the leased lands shall become the property of the lessor on expiration of the 90-day period or such extension thereof as may be granted because of adverse climatic conditions, but the lessee shall remove any or all of such property where so directed by the lessor.

Sec. 7. *Proceedings in case of default.* If the lessee shall not comply with any of the provisions of the act or the regulations thereunder or default in the performance or observance of any of the provisions of this lease, and such default shall continue for a period of 30 days after service of written notice thereof by the lessor, the lessor may institute appropriate proceedings in a court of competent jurisdiction for the forfeiture and cancellation of this lease as provided in section 31 of the act. If the lessee fails to take prompt and necessary steps to prevent loss or damage to the mine, property, or premises, or danger to the employees, the lessor may enter on the premises and take such measures as may be deemed necessary to prevent such loss or damage or to correct the dangerous or unsafe condition of the mine or works thereof, which shall be at the expense of the lessee. However, the lessee shall

not be held responsible for delays or casualties occasioned by causes beyond the lessee's control.

Sec. 8. *Heirs and successors in interest.* Each obligation hereunder shall extend to, and be binding upon, and every benefit hereof shall inure to, the heirs, executors, administrators, successors, or assigns of the respective parties hereto.

Sec. 9. *Unlawful interest.* No Member of, or Delegate to, Congress, or Resident Commissioner, after his

election or appointment, or either before or after he has qualified and during his continuance in office, and no officer, agent, or employee of the Department of the Interior, except as provided in 43 CFR 7.4(a)(1), shall be admitted to any share or part in this lease or derive any benefit that may arise therefrom; and the provisions of Section 3741 of the Revised Statutes of the United States, as amended (41 U.S.C. Sec. 22), and Sections 431, 432, and 433, Title 18, U.S.C., relating to contracts, enter into and form a part of this lease so far as the same may be applicable.

THE UNITED STATES OF AMERICA

By *Daniel Y. Moschler*
(Signing Officer)

Daniel Y. Moschler
Assistant Manager, Mining

(Title)

NOV 17 1967

(Date)

WITNESS TO SIGNATURE OF LESSEE

Attest *G. H. Shipley*
ASSISTANT SECRETARY

HUMBLE OIL & REFINING COMPANY

G. H. Shipley O. K. as to
transaction
U. S. DEPT. OF
INTERIOR
6-1-2
(Signature of Lessee)

G. H. Shipley, Vice President

(Signature of Lessee)

(Signature of Lessee)

(If this lease is executed by a corporation, it must bear the corporate seal)

(c) **Royalty:**

To pay the lessor a royalty of $17\frac{1}{2}$ cents a ton of 2,000 pounds for coal mined for the first 10 years of the lease and 20 cents a ton for the remainder of the first 20 year period succeeding the execution of this lease.

24
Initial

Special Stipulation:

The lessee will notify the District Manager, Bureau of Land Management, 300 North Center Street, Casper, Wyoming, of his plans for mining prior to commencement of any operations.

24
Initial

O. K. as to
transaction
U. S. DEPT. OF
INTERIOR
6-1-2
gnc RD

Lease and Permit Amendment

CONDITIONS FOR THE PROTECTION OF
THE SURFACE, NATURAL RESOURCES, AND IMPROVEMENTS

The lessee/permittee agrees to take such reasonable steps as may be needed to prevent operations from unnecessarily: (1) causing or contributing to soil erosion or damaging any forage and timber growth thereon, or on Federal and non-Federal lands in the vicinity; (2) polluting water; (3) damaging crops, including forage, timber, or improvements of a surface owner; or (4) damaging improvements whether owned by the United States or by its permittees or lessees; and upon any partial or total relinquishment or the cancellation or expiration of this lease, or at any other time prior thereto when required and to the extent deemed necessary by the lessor, to fill any sump holes, ditches, and other excavations, remove or cover all debris, and, so far as reasonably possible, restore the surface of the leased land and access roads to their former condition, including the removal of structures as and if required. The lessor may prescribe the steps to be taken and restoration to be made, with respect to lands of the United States and improvements thereon.

HUMBLE OIL & REFINING COMPANY
Lessee/Permittee

By *G. H. Shipley*
G. H. Shipley
Vice President
Title

O. K. as to *guc RDS*
transaction
O. K. as to
Form *2-5*

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

COAL LEASE

922

Land Office Serial Number

WYOMING

W-23928

This lease, entered into on **SEP 1 1970**

, by the United States of America, the lessor,

through the Bureau of Land Management, and

Kerr-McGee Corporation
Kerr-McGee Building
Oklahoma City, Oklahoma 73102

, the lessee,
pursuant and subject to the terms and provisions of the act of February 25, 1920 (41 Stat. 437), as amended, hereinafter referred to as the act, and to all reasonable regulations of the Secretary of the Interior now or hereafter in force which are made a part hereof,

WITNESSETH:

Sec. 1. *Rights of Lessee.* The lessor, in consideration of the rents and royalties to be paid and the conditions to be observed as hereinafter set forth does hereby grant and lease to the lessee the exclusive right and privilege to mine and dispose of all the coal in the following-described tracts of land, situated in the State of **Wyoming**

- T. 43 N., R. 69 W., 6th P.M.,
Sec. 6: Lot 7
Sec. 7: Lots 1, 2, 3, E $\frac{1}{2}$ NW $\frac{1}{4}$, NE $\frac{1}{4}$ SW $\frac{1}{4}$
T. 43 N., R. 70 W., 6th P.M.
Sec. 1: Lots 2, 3, 4, S $\frac{1}{2}$ N $\frac{1}{2}$, S $\frac{1}{2}$
Sec. 2: All
Sec. 3: All
Sec. 10: All
Sec. 11: N $\frac{1}{2}$, NE $\frac{1}{4}$ SW $\frac{1}{4}$, NW $\frac{1}{4}$ SE $\frac{1}{4}$
Sec. 12: N $\frac{1}{2}$, E $\frac{1}{2}$ SE $\frac{1}{4}$
Sec. 14: SW $\frac{1}{4}$ NW $\frac{1}{4}$, S $\frac{1}{2}$ SW $\frac{1}{4}$
Sec. 15: N $\frac{1}{2}$, N $\frac{1}{2}$ S $\frac{1}{2}$

containing **4,191.84** acres, more or less, together with the right to construct all such works, buildings, plants, structures, and appliances as may be necessary and convenient for the mining and preparation of the coal for market, the manufacture of coke or other products of coal, the housing and welfare of employees, and subject to the conditions herein provided, to use so much of the surface as may reasonably be required in the exercise of the rights and privileges herein granted.

Sec. 2. In consideration of the foregoing, the lessee hereby agrees:

(a) *Bond.* To maintain the bond furnished upon the issuance of this lease, which bond is conditioned upon compliance with all the provisions of the lease, and to increase the amount or furnish such other bond as may be required.

(b) *Rental.* To pay the lessor annually, in advance, for each acre or fraction thereof covered by this lease, beginning with the date hereof, the following rentals: 25 cents for the first year; 50 cents for the second, third, fourth, and fifth years, respectively; and \$1 for the sixth and each succeeding year during the continuance of the lease, such rental for any year to be credited against the first royalties as they accrue under the lease during the year for which the rental was paid.

For additional rental terms, see last page.

(c) *Royalty.* To pay the lessor a royalty of cents on every ton of 2,000 pounds of coal mined during the first 20 years succeeding the execution of this lease. Royalties shall be payable quarterly within

30 days from the expiration of the quarter in which the coal is mined. **For additional royalty terms, see last page.**

(d) *Minimum production.* Beginning with the sixth year of the lease, *except* when operations are interrupted by strikes, the elements, or casualties not attributable to the lessee, or unless on application and showing made, operations shall be suspended when market conditions are such that the lessee cannot operate *except* at a loss or suspended for the other reasons specified in section 39 of the act, to mine coal each year and pay a royalty thereon to a value of \$1 per acre or fraction thereof. Operations under this lease shall be continuous *except* in circumstances described or unless the lessee shall pay a royalty, less rent, on such minimum amount of the leased deposits, for one year in advance, in which case operations may be suspended for that year.

(e) *Payments.* To make rental payments to the manager of the appropriate land office, *except* that when this lease becomes productive the rentals and

ORIGINAL

royalties shall be paid to the appropriate Regional Mining Supervisor of the United States Geological Survey, with whom all reports concerning operations under the lease shall be filed. All remittances to the Manager of the Land Office shall be made payable to the Bureau of Land Management, those to the Geological Survey shall be made payable to the United States Geological Survey.

(f) *Plats, reports, maps.* At such times and in such form as the lessor may prescribe, to furnish a plat showing development work and improvements on the leased lands and a report with respect to stockholders, investment, depreciation, and costs. To furnish in such form as the lessor may prescribe, within 30 days from the expiration of each quarter a report covering such quarter, certified by the superintendent of the mine, or by such other agent having personal knowledge of the facts as may be designated by the lessee for such purpose, showing the amount of leased deposits mined during the quarter, the character and quality thereof, amount of its products and byproducts disposed of and price received therefor, and amount in storage or held for sale. To keep and prepare maps of the leased lands in accordance with the appropriate regulations.

(g) *Weights.* To determine accurately the weight or quantity and quality of all leased deposits mined, and to enter accurately the weight or quantity and quality thereof in due form in books to be kept and preserved by the lessee for such purposes.

(h) *Inspection.* To permit at all reasonable times (1) inspection by any duly authorized officer of the Department, of the leased premises and all surface and underground improvements, works, machinery, equipment, and all books and records pertaining to operations and surveys or investigations under this lease; and (2) the lessor to make copies of and extracts from any or all books and records pertaining to operations under this lease, if desired.

(i) *Assignment.* To file for approval in the appropriate Land Office within 90 days from the date of execution, any assignment or transfer made of this lease, whether by direct assignment, operating agreement, working or royalty interest, or otherwise. Such instrument will take effect the first day of the month following its approval by the Bureau of Land Management, or if the assignee requests, the first day of the month of approval. The showing required to be made with an assignment or transfer is set forth in the appropriate regulations.

(j) *Equal Opportunity clause.* During the performance of this contract the lessee agrees as follows:

(1) The lessee will not discriminate against any employee or applicant for employment because of race, creed, color, or national origin. The lessee will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, creed, color, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The lessee agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause.

(2) The lessee will, in all solicitations or advertisements for employees placed by or on behalf of the lessee, state that all qualified applicants will receive consideration for employment without regard to race, creed, color, or national origin.

(3) The lessee will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the agency contracting officer, advising the labor union of workers' representative of the lessee's commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The lessee will comply with all provisions of Executive Order No. 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(5) The lessee will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the lessee's noncompliance with the nondiscrimination clauses of this contract or with any of such rules, regulations, or orders, this contract may be cancelled, terminated or suspended in whole or in part and the lessee may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The lessee will include the provisions of Paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The lessee will take such action with respect to any subcontract or purchase order as the contracting agency may direct as a means of enforcing such provisions including sanctions for noncompliance; *Provided, however,* That in the event the lessee becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the contracting agency, the lessee may request the United States to enter into such litigation to protect the interest of the United States.

(k) *Land disposed of with coal deposits reserved to the United States.* If the lands embraced herein have been or shall hereafter be disposed of under laws reserving to the United States the deposits of coal therein, to comply with all conditions as are or may hereafter be provided by the laws and regulations reserving such coal.

(l) *Operations, wages, freedom of purchase.* To comply with the appropriate operating regulations, to exercise reasonable diligence, skill, and care in the operations of the property, and to carry on all operations in accordance with approved methods and practices as provided in the operating regulations, having due regard for the prevention of injury to life, health or property, and of waste or damage to any water or mineral deposits; to fairly and justly weigh or measure the coal mined by each miner, to pay all wages due miners and employees, both above and below ground, at least twice each month in lawful money of the United States; to accord all miners and employees complete freedom of purchase; to restrict the workday to not exceeding eight hours in any one day for underground

workers, except in cases of emergency; to employ no boy under the age of sixteen and no girl or woman, without regard to age, in any mine below the surface; unless the laws of the State otherwise provide, in which case the State laws control.

(m) *Taxes.* To pay when due, all taxes lawfully assessed and levied under the laws of the State or the United States upon improvements, output of mines, or other rights, property, or assets of the lessee.

(n) *Overriding royalties.* Not to create, by assignment or otherwise, an overriding royalty interest in excess of 50 percent of the rate of royalty first payable to the United States under this lease or an overriding royalty interest which when added to any other outstanding overriding royalty interest exceeds that percentage, excepting, that where an interest in the leasehold or in an operating agreement is assigned, the assignor may retain an overriding royalty interest in excess of the above limitation if he shows to the satisfaction of the Bureau of Land Management, that he has made substantial investments for improvements on the land covered by the assignment.

(o) *Delivery of premises in case of forfeiture.* In case of forfeiture of this lease, to deliver up to the lessor in good order and condition the land leased, including all buildings, and underground timbering and such other supports and structures as are necessary for the preservation of the mine or deposit.

Sec. 3. The lessor expressly reserves:

(a) *Rights reserved.* The right to permit for joint or several use such easements or rights-of-way, including easements in tunnels upon, through, or in the land leased, occupied, or used as may be necessary or appropriate to the working of the same or other lands containing the deposits described in the Act, and the treatment and shipment of the products thereof by or under authority of the Government, its lessees or permittees, and for other public purposes.

(b) *Disposition of surface.* The right to lease, sell, or otherwise dispose of the surface of the leased lands under existing law or laws hereafter enacted, insofar as said surface is not necessary for the use of the lessee in the extraction and removal of the coal therein, or to dispose of any resource in such lands which will not unreasonably interfere with operations under this lease.

(c) *Monopoly and fair prices.* Full power and authority to promulgate and enforce all the provisions of Section 30 of the Act to insure the sale of the production of said leased lands to the United States and to the public at reasonable prices, to prevent monopoly, and to safeguard the public welfare.

(d) *Readjustment of terms.* The right reasonably to readjust and fix royalties payable hereunder and other terms and conditions at the end of 20 years from the date hereof and thereafter at the end of each succeeding 20-year period during the continuance of this lease unless otherwise provided by law at the time of the expiration of any such period. Unless the lessee files objections to the proposed terms or a relinquishment of the lease within 30 days after receipt of the notice of proposed terms for a 20-year period, he will be deemed to have agreed to such terms.

(e) *Waiver of conditions.* The right to waive any breach of the conditions contained herein, except the breach of such conditions as are required by the Act, but any such waiver shall extend only to the particular breach so waived and shall not limit the rights of the

lessor with respect to any future breach; nor shall the waiver of a particular cause of forfeiture prevent cancellation of this lease for any other cause, or for the same cause occurring at another time.

Sec. 4. *Relinquishment of lease.* Upon a satisfactory showing that the public interest will not be impaired, the lessee may surrender the entire lease or any legal subdivision thereof. A relinquishment must be filed in duplicate in the appropriate Land Office. Upon its acceptance it shall be effective as of the date it is filed, subject to the continued obligation of the lessee and his surety to make payment of all accrued rentals and royalties and to provide for the preservation of any mines or productive works or permanent improvements on the leased lands in accordance with the regulations and terms of the lease.

Sec. 5. *Protection of the surface, natural resources, and improvements.* The lessee agrees to take such reasonable steps as may be needed to prevent operations from unnecessarily: (1) causing or contributing to soil erosion or damaging any forage and timber growth thereon; (2) polluting the waters of springs, streams, wells, or reservoirs; (3) damaging crops, including forage, timber, or improvements of a surface owner; or (4) damaging range improvements whether owned by the United States or by its grazing permittees or lessees; and upon any partial or total relinquishment or the cancellation or expiration of this lease, or at any other time prior thereto when required by the lessor and to the extent deemed necessary by the lessor, to fill any sump holes, ditches and other excavations, remove or cover all debris, and, so far as reasonably possible, restore the surface of the leased land to its former condition, including the removal of structures as and if required. The lessor may prescribe the steps to be taken and restoration to be made with respect to lands of the United States and improvements thereon.

Sec. 6. *Removal of equipment, etc., on termination of lease.* Upon termination of this lease, by surrender or forfeiture, the lessee shall have the privilege at any time within a period of 90 days thereafter of removing from the premises all machinery, equipment, tools and materials, except underground timbering placed by the lessee in or on the leased lands, which are necessary for the preservation of the mine. Any materials, tools, appliances, machinery, structures, and equipment, subject to removal as above provided, which are allowed to remain on the leased lands shall become the property of the lessor on expiration of the 90-day period or such extension thereof as may be granted because of adverse climatic conditions, but the lessee shall remove any or all of such property where so directed by the lessor.

Sec. 7. *Proceedings in case of default.* If the lessee shall not comply with any of the provisions of the Act or the regulations thereunder or default in the performance or observance of any of the provisions of this lease, and such default shall continue for a period of 30 days after service of written notice thereof by the lessor, the lessor may institute appropriate proceedings in a court of competent jurisdiction for the forfeiture and cancellation of this lease as provided in Section 31 of the Act. If the lessee fails to take prompt and necessary steps to prevent loss or damage to the mine, property, or premises, or danger to the employees, the lessor may enter on the premises and take such measures as may be deemed necessary to prevent such loss or damage or to correct the dangerous or unsafe condition of the mine or works thereof, which shall be at the expense of the lessee. However, the lessee shall

not be held responsible for delays or casualties occasioned by causes beyond the lessee's control.

Sec. 8. *Heirs and successors in interest.* Each obligation hereunder shall extend to, and be binding upon, and every benefit hereof shall inure to, the heirs, executors, administrators, successors, or assigns of the respective parties hereto.

Sec. 9. *Unlawful interest.* No Member of, or Delegate to, Congress, or Resident Commissioner, after his

election or appointment, or either before or after he has qualified and during his continuance in office, and no officer, agent, or employee of the Department of the Interior, except as provided in 43 CFR 7.4(a)(1), shall be admitted to any share or part in this lease or derive any benefit that may arise therefrom; and the provisions of section 3741 of the Revised Statutes of the United States, as amended (41 U.S.C. Sec. 22), and sections 431, 432, and 433, Title 18, U.S.C., relating to contracts, enter into and form a part of this lease so far as the same may be applicable.

THE UNITED STATES OF AMERICA

By

Daniel M. Moschler
(Signature of Officer)

Daniel M. Moschler
Assistant Manager, Mining
(Title)

AUG 14 1970
(Date)

WITNESS TO SIGNATURE OF LESSEE

KERR-McGEE CORPORATION

(Signature of Lessee)

ATTEST:

By:

J. C. Finley
(Signature of Lessee)
J. C. Finley, Vice President

Clark R. Dudley
Asst. Secretary

(Signature of Lessee)

(If this lease is executed by a corporation, it must bear the corporate seal)

- (b) Rental. If by the end of the fifth lease year production royalty for any lease year has not equalled or exceeded \$5 an acre, or fraction thereof, the rental for the sixth and each succeeding year shall be increased from \$1 to \$5 an acre, or fraction thereof, until such time as production royalty for any lease year equals or exceeds the latter amount, whereupon the rental shall revert to \$1 an acre, or fraction thereof.

[Signature]
Initial

- (c) Royalty. To pay the lessor a royalty of 17½ cents a ton of 2,000 pounds for the first 10 years of the lease, and 20 cents a ton of 2,000 pounds for the remainder of the first 20-year period succeeding the date of this lease.

[Signature]
Initial

Bond in sum of \$ 75,000.00
with cash as surety filed.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

1970

W-23928

3

STIPULATION FOR LANDS UNDER JURISDICTION OF DEPARTMENT OF AGRICULTURE *

The lands embraced in this lease or permit being under the jurisdiction of the Secretary of Agriculture, the lessee or permittee hereby agrees:

(1) To conduct all operations authorized by this lease or permit with due regard for good land management, not to cut or destroy timber without first obtaining permission from the authorized representative of the Secretary of Agriculture, and to pay for all such timber cut or destroyed at the rates prescribed by such representative; to avoid unnecessary damage to improvements, timber, crops, or other cover; unless otherwise authorized by the Secretary of Agriculture, not to drill any well, carry on operations, make excavations, construct tunnels, drill, or otherwise disturb the surface of the lands within 200 feet of any building standing on the lands and whenever required, in writing, by the authorized representative of the Secretary of Agriculture to fence or fill all sump holes, ditches, and other excavations, remove or cover all debris, and so far as reasonably possible, restore the surface of the lands to their former condition, including the removal of structures as and if required, and when required by such representative to bury all pipelines below plow depth.

(2) To do all in his power to prevent and suppress forest, brush, or grass fires on the lands and in their vicinity, and to require his employees, contractors, subcontractors, and employees of contractors or subcontractors to do likewise. Unless prevented by circumstances over which he has no control, the lessee or permittee shall place his employees, contractors, subcontractors, and employees of contractors and subcontractors employed on the lands at the disposal of any authorized officer of the Department of Agriculture for the purpose of fighting forest, brush, or grass fires on or originating on the lands or on adjacent areas or caused by the negligence of the lessee or permittee or his employees, contractors, subcontractors and employees of contractors and subcontractors, with the understanding that payment for such services shall be made at rates to be determined by the authorized representative of the Secretary of

Agriculture, which rates shall not be less than the current rates of pay prevailing in the vicinity for services of a similar character: *Provided*, that if the lessee or permittee, his employees, contractors, subcontractors, or employees of contractors or subcontractors, caused or could have prevented the origin or spread of said fire or fires, no payment shall be made for services so rendered.

During periods of serious fire danger to forest, brush, or grass, as may be specified by the authorized representative of the Secretary of Agriculture, the lessee or permittee shall prohibit smoking and the building of camp and lunch fires by his employees, contractors, subcontractors, and employees of contractors or subcontractors within the area involved except at established camps, and shall enforce this prohibition by all means within his power: *Provided*, that the authorized representative of the Secretary of Agriculture may designate safe places where, after all inflammable material has been cleared away, campfires may be built for the purpose of heating lunches and where, at the option of the lessee or permittee, smoking may be permitted.

The lessee or permittee shall not burn rubbish, trash, or other inflammable materials *except* with the consent of the authorized representative of the Secretary of Agriculture and shall not use explosives in such a manner as to scatter inflammable materials on the surface of the lands during the forest, brush, or grass fire season, *except* as authorized to do so or on areas approved by such representative.

The lessee or permittee shall build or construct such fire lines or do such clearing on the lands as the authorized representative of the Secretary of Agriculture decides is essential for forest, brush, and grass fire prevention which is or may be necessitated by the

* This form of stipulation may be used in connection with leases and permits issued under the Acts of February 25, 1920, as amended (30 U.S.C. 181 *et seq.*); August 7, 1947 (30 U.S.C. 351 *et seq.*); February 7, 1927, as amended (30 U.S.C. 281 *et seq.*); April 17, 1926, as amended (30 U.S.C. 271 *et seq.*); October 20, 1914, as

amended (48 U.S.C. 432 *et seq.*); June 28, 1944 (58 Stat 463 *et seq.*); September 1, 1949 (30 U.S.C. 192c); June 30, 1950 (16 U.S.C. 508b); or under the authority of any of the Acts cited in Section 402 of the President's Reorganization Plan No. 3 of 1946 (5 U.S.C. 133y-16, Note).

exercise of the privileges authorized by this lease or permit, and shall maintain such fire tools at his headquarters or at the appropriate location on the lands as are deemed necessary by such representative.

(3) In the location, design, construction and maintenance of all authorized works, buildings, plants, waterways, roads, telegraph or telephone lines, pipelines, reservoirs, tanks, pumping stations, or other structures or clearance, the lessee or permittee shall do all things reasonably necessary to prevent or reduce to the fullest extent scarring and erosion of the lands, pollution of the water resources and any damage to the watershed. Where construction, operation, or maintenance of any of the facilities on or connected with this lease or permit causes damage to the watershed or pollution of the water resources, the lessee or permittee agrees to repair such damage and to take such corrective measures to prevent further pollution or damage to the watershed as are deemed necessary by the authorized representative of the Secretary of Agriculture.

(4) To pay the lessor or permitter or his tenant or the surface owner or his tenant, as the case may be, for any and all damage to or destruction of property caused by the lessee's or permittee's operations hereunder; to save and hold the lessor or permitter or the surface owner or their tenants harmless from all damage or claims for damage to persons or property resulting from the lessee's or permittee's operations under this lease or permit.

(5) To recognize existing uses and commitments, in the form of Department of Agriculture grazing, timber cutting, and special use permits, water developments, ditch, road, trail, pipeline, telephone line, and fence rights-of-way and other similar improvements, and to conduct his operations so as to interfere as little as possible with the rights and privileges granted by these permits or with other existing uses.

(6) To install and maintain cattle guards to prevent the passage of livestock in any openings made in fences by the lessee or permittee or his contractors to provide access to the lands covered by this lease or permit for automotive and other equipment.

(7) If lessee or permittee shall construct any camp on the lands, such camp shall be located at a place approved by the authorized representative of the Secretary of Agriculture, and such representative shall have authority to require that such camp be kept in a neat and sanitary condition.

(8) To comply with all the rules and regulations of the Secretary of Agriculture governing the national forests or other lands under his jurisdiction which are embraced in this lease or permit.

(9) Unless otherwise authorized, prior to the beginning of operations to appoint and maintain at all times during the term of this lease or permit a local agent upon whom may be served written orders or notices respecting matters contained in this stipulation, and to inform the authorized representative of the Secretary of Agriculture, in writing, of the name and address of such agent. If a substitute agent is appointed, the lessee or permittee shall immediately so inform the said representative.

(10) To address all matters relating to this stipulation to

Forest Supervisor

U.S. Forest Service

at

National Forest
Caramia, Arizona 82070

who is the authorized representative of the Secretary of Agriculture, or to such other representative as may from time to time, be designated, provided that such designation shall be in writing and be delivered to the lessee or permittee or his agent.

(11) If all or any part of the lands lie within a municipal watershed, or are, in the opinion of the authorized representative of the Secretary of Agriculture, primarily valuable for watershed protection, the lessee or permittee shall reseed or otherwise restore the vegetative cover, as required by the authorized representative of the Secretary of Agriculture, for watershed protection and erosion prevention on any areas damaged because of the operation.

KERR-MCGEE CORPORATION

By:

J. C. Finley
(Signature of Lessee)
J. C. Finley, Vice President

GPO 844-923

~~W-7456~~
W-23928

SUPPLEMENTAL STIPULATION TO
STIPULATION FOR LANDS UNDER JURISDICTION OF DEPARTMENT OF AGRICULTURE

To be attached to and made a part of Form 3103-2.

A. Applicable to Exploration Activities

1. At least two weeks before beginning any exploration work, including access and work road location and construction, the lessee shall prepare a "Lessee Exploration Plan" with the District Ranger, Douglas Thompson. The plan shall be prepared in triplicate, including maps, for approval by the Forest Supervisor. Such approval will be conditioned on reasonable requirements needed to prevent soil erosion, water pollution, and unnecessary damages to the surface vegetation and other resources of the United States and to provide for the restoration of the land surface and vegetation. The plan shall contain all such provisions as the Forest Service may deem necessary to maintain proper management of the lands and resources within the exploration area.

Where appropriate, depending upon the location and type of operation, the Forest Supervisor may require the plan to contain, at a minimum, the following items:

- (a) The location, construction specifications, maintenance program, and estimated use by the lessee, his employees and agents, of all access and work roads.
- (b) The location and extent of any and all areas to be occupied during the explorations.
- (c) The methods to be used in the explorations, including disposal of waste material.
- (d) The size and type of equipment to be used in the explorations.
- (e) The capacity, size, character, standards of construction and location of all structures and facilities to be constructed.
- (f) Typical profiles of cuts and fills of all areas to be graded for the installation of structures and facilities.
- (g) The location and size of areas upon which vegetation will be destroyed and/or soil laid bare and the steps which will be taken to prevent and control soil erosion thereon, including but not limited to the proposed program for rehabilitation and revegetation of these disturbed lands both during and upon cessation of explorations.
- (h) The steps which will be taken to prevent water pollution.

- (i) The character, amount, and time of use of explosives or fire, including safety precautions which will be taken during their use.
- (j) The coordination and rehabilitation measures that will be taken to protect other uses of the land, permitted livestock, and wildlife.

If later explorations require departures from or additions to the approved plan, these revisions or amendments, together with justification statement for proposed revisions, will be submitted to the District Ranger for approval of the Forest Supervisor.

Any and all operations conducted in advance of approval of an original, revised, or amended exploration plan, or which are not in accord with an approved plan, constitute a violation of the terms of this lease and the Forest Service reserves the right to close down explorations until such corrective action, as is deemed necessary, is taken by the lessee.

2. To guarantee the successful rehabilitation and revegetation of abandoned exploration sites, roads and other disturbed areas, as provided for in the "Lessee Exploration Plan," (paragraph 1) above, the lessee will furnish the Forest Service a surety bond in the amount of \$10,000 prior to undertaking any work on the lease area. Provided that, in the event the work is conducted in separate phases, each phase will be covered by a separate bond in the minimum amount of \$10,000 before the start of any work on each phase. In lieu of surety bond, the lessee may deposit into a Federal Depository cash, through the Unit Collection Officer, Marvin Fout National Forest, or negotiable securities through the Regional Fiscal Agent, U. S. Forest Service, Bldg. 35, Denver Federal Center, Denver, Colorado 80225 in the amounts stated above or each separately bonded phase area. As soon as the lease area has been successfully rehabilitated and revegetated and approved in writing by the Forest Supervisor, surety will be notified, or cash deposits returned without interest, or securities returned without interest. The lessee agrees that all monies or deposits in lieu thereof, deposited under this authority may be retained by the United States to cover the cost of any said restoration and rehabilitation rendered necessary by failure of the lessee to fulfill all and singular the requirements assumed hereunder without prejudice whatever to any other rights and remedies of the United States.
3. No occupancy of the surface of the following areas is authorized by this lease. The lessee is, however, authorized to employ directional drilling to explore the mineral resources under these areas provided that such drilling or other works will not disturb the surface area or otherwise interfere with their use by the Forest

Service. It is understood and agreed that the use of these areas for National Forest purposes is superior to any other use. The excluded areas are:

- (a) Within the normal highwater line of any and all lakes, ponds, and reservoirs located within the lease area.
- (b) Within 200 feet of the normal highwater line of any and all live streams in the area.
- (c) Within 400 feet of any and all springs and wells within the lease area.
- (d) Within 400 feet of any improvements either owned, permitted, leased, or otherwise authorized by the Forest Service.

The distances in subparagraphs (a), (b), (c), and (d) may be reduced when specifically agreed to in the exploration plan, (paragraph 1).

B. Applicable to Production (operation) Activities

1. The lessee, before the start of any mining operations, agrees to enter into such additional specific stipulations with the Forest Service covering the lessee's mining operations as are deemed necessary and appropriate, depending upon the mining methods to be used and current mining and restoration technology, to meet the following land management principles:

- (a) Maintain and protect the areas which will be either directly or indirectly affected by the lessee's mining operations to minimize the effect on grazing capabilities.
- (b) Install structures and facilities and revegetate disturbed areas to protect the soil from excessive erosion and return the land to a usable condition.
- (c) Take all measures reasonably necessary to minimize the pollution and contamination of the surface and subsurface water sources.
- (d) Protect, insofar as is practicable, improvements owned or authorized by the Forest Service, and restore or replace these said improvements in event they must be destroyed or disturbed by the lessee's mining operations.

Such stipulations will be developed jointly by the lessee; representatives of the Branch of Mining Operations Conservation Division, U. S. Geological Survey; and the Supervisor,
Medicine River, Forest Service.

2. The lessee shall prepare in triplicate and submit an annual operating plan to the Forest Supervisor which will include as a minimum:
 - (a) The mining operating areas and the methods of operation planned for each area.
 - (b) The areas to be treated and details of the rehabilitation and revegetation measures to be initiated in the planning year to meet the stipulated requirements of the Forest Service.
 - (c) The location and construction specifications of all roads necessary for the mining operation during the planning year.
 - (d) The steps to be taken to minimize water pollution and soil erosion.
 - (e) The correlation of the mining operations with the Forest Service's use and management of the lands not included in that year's operating plan.
3. The lessee shall submit to the Forest Supervisor an annual progress map and report of mining, restoration, and revegetation operations.
4. The lessee shall furnish performance bonds as required by the Forest Supervisor to guarantee fulfillment of the stipulations, entered under (1) above, and the operating plans, prepared under (2) above.
5. The Forest Service reserves the right to amend, alter, or otherwise change during the life of the lease, any and all stipulations necessary to meet the land management principles outlined in paragraph 1 above provided that before any such amendments, alterations, and other changes are made, the lessee shall be invited to make any comments as he may deem necessary and, provided further, that no such amendments, alterations, and changes in these stipulations shall be made unless agreed to in writing by the lessee and the Forest Service.
6. The Forest Service reserves the right to manage and use all lands administered by it which are embraced within the lease for such purposes as they may deem desirable, provided, that this use and management shall not interfere or conflict with the current mining operations of the lessee.

KERR-MCCLE CORPORATION

By: J. C. Finley ^{FORM} ^{APPROVED} ^{LAW DEPT.}
Vice President

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

EQUAL OPPORTUNITY IN EMPLOYMENT
CERTIFICATION OF NONSEGREGATED FACILITIES

Bid, offer or contract number or
other identification:

W-23928

By the submission of this bid or offer and/or by entering into this contract, the bidder, offeror, lessee, subcontractor, or applicant certifies that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. He certifies further that he will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The bidder, offeror, applicant, or subcontractor agrees that a breach of this certification is a violation of the Equal Opportunity clause in this contract. As used in this certification, the term "segregated facilities" means, but is not limited to, any waiting rooms, work areas, rest rooms and wash rooms, restaurants and

other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, creed, color, or national origin, because of habit, local custom, or otherwise. He further agrees that (except where he has obtained identical certifications from proposed subcontractors for specific time periods) he will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity clause; that he will retain such certifications in his files; and that he will forward the following notice to such proposed subcontractors (except where the proposed subcontractors have submitted identical certifications for specific time periods):

NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENT
FOR CERTIFICATIONS OF NONSEGREGATED FACILITIES

A Certification of Nonsegregated Facilities, as required by the May 9, 1967, order (32 F.R. 7439, May 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted prior to the award of a subcontract exceeding \$10,000 which is not exempt from the

provisions of the Equal Opportunity clause. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e., quarterly, semiannually, or annually).

In accordance with 41 CFR 60, as amended May 19, 1967, and Executive Order No. 11246 of September 24, 1965, this certification is applicable to all bids, offers, contracts and subcontracts as well as agreements with applicants who are themselves performing federally assisted contracts, which may exceed \$10,000 and are not exempt from the provisions of the Equal Opportunity clause of the Order.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

COAL LEASE

922

Land Office Serial Number

WYOMING

W-24710 (Acquired)

This lease, entered into on **SEP 1 1970**

by the United States of America, the lessor,

through the Bureau of Land Management, and **Kerr McGee Corporation**
Kerr-McGee Building
Oklahoma City, Oklahoma 73102

Acquired Lands Leasing Act of August 7, 1947,
(61 Stat. 913; 30 U.S.C. 351 et seq.)
pursuant and subject to the terms and provisions of the ~~act of February 26, 1920 (41 Stat. 437)~~, as amended, herein-
after referred to as the act, and to all reasonable regulations of the Secretary of the Interior now or hereafter in force
which are made a part hereof,

WITNESSETH:

Sec. 1. *Rights of Lessee.* The lessor, in consideration of the rents and royalties to be paid and the conditions to be
observed as hereinafter set forth does hereby grant and lease to the lessee the exclusive right and privilege to mine
and dispose of all the coal in the following-described tracts of land, situated in the State of **Wyoming**

T. 43 N., R. 70 W., 6th P.M.,
Sec. 12: N $\frac{1}{2}$ SW $\frac{1}{4}$, W $\frac{1}{2}$ SE $\frac{1}{4}$

containing **160.00** acres, more or less, together with the right to construct all such works, buildings, plants,
structures, and appliances as may be necessary and convenient for the mining and preparation of the coal for market,
the manufacture of coke or other products of coal, the housing and welfare of employees, and subject to the conditions
herein provided, to use so much of the surface as may reasonably be required in the exercise of the rights and privi-
leges herein granted.

Sec. 2. In consideration of the foregoing, the lessee
hereby agrees:

(a) *Bond.* To maintain the bond furnished upon
the issuance of this lease, which bond is conditioned
upon compliance with all the provisions of the lease,
and to increase the amount or furnish such other bond
as may be required.

(b) *Rental.* To pay the lessor annually, in ad-
vance, for each acre or fraction thereof covered by this
lease, beginning with the date hereof, the following
rentals: 25 cents for the first year; 50 cents for the
second, third, fourth, and fifth years, respectively; and
\$1 for the sixth and each succeeding year during the
continuance of the lease, such rental for any year to be
credited against the first royalties as they accrue under
the lease during the year for which the rental was paid.
For additional rental terms, see last page.

(c) *Royalty.* To pay the lessor a royalty of
cents on every ton of 2,000 pounds of coal mined during
the first 20 years succeeding the execution of this
lease. Royalties shall be payable quarterly within

30 days from the expiration of the quarter in which the
coal is mined. **For additional royalty terms,
see last page.**

(d) *Minimum production.* Beginning with the sixth
year of the lease, *except* when operations are inter-
rupted by strikes, the elements, or casualties not
attributable to the lessee, or unless on application and
showing made, operations shall be suspended when
market conditions are such that the lessee cannot op-
erate *except* at a loss or suspended for the other
reasons specified in section 39 of the act, to mine coal
each year and pay a royalty thereon to a value of \$1 per
acre or fraction thereof. Operations under this lease
shall be continuous *except* in circumstances described
or unless the lessee shall pay a royalty, less rent, on
such minimum amount of the leased deposits, for one
year in advance, in which case operations may be
suspended for that year.

(e) *Payments.* To make rental payments to the
manager of the appropriate land office, *except* that
when this lease becomes productive the rentals and

ORIGINAL

royalties shall be paid to the appropriate Regional Mining Supervisor of the United States Geological Survey, with whom all reports concerning operations under the lease shall be filed. All remittances to the Manager of the Land Office shall be made payable to the Bureau of Land Management, those to the Geological Survey shall be made payable to the United States Geological Survey.

(f) *Plats, reports, maps.* At such times and in such form as the lessor may prescribe, to furnish a plat showing development work and improvements on the leased lands and a report with respect to stockholders, investment, depreciation, and costs. To furnish in such form as the lessor may prescribe, within 30 days from the expiration of each quarter a report covering such quarter, certified by the superintendent of the mine, or by such other agent having personal knowledge of the facts as may be designated by the lessee for such purpose, showing the amount of leased deposits mined during the quarter, the character and quality thereof, amount of its products and byproducts disposed of and price received therefor, and amount in storage or held for sale. To keep and prepare maps of the leased lands in accordance with the appropriate regulations.

(g) *Weights.* To determine accurately the weight or quantity and quality of all leased deposits mined, and to enter accurately the weight or quantity and quality thereof in due form in books to be kept and preserved by the lessee for such purposes.

(h) *Inspection.* To permit at all reasonable times (1) inspection by any duly authorized officer of the Department, of the leased premises and all surface and underground improvements, works, machinery, equipment, and all books and records pertaining to operations and surveys or investigations under this lease; and (2) the lessor to make copies of and extracts from any or all books and records pertaining to operations under this lease, if desired.

(i) *Assignment.* To file for approval in the appropriate Land Office within 90 days from the date of execution, any assignment or transfer made of this lease, whether by direct assignment, operating agreement, working or royalty interest, or otherwise. Such instrument will take effect the first day of the month following its approval by the Bureau of Land Management, or if the assignee requests, the first day of the month of approval. The showing required to be made with an assignment or transfer is set forth in the appropriate regulations.

(j) *Nondiscrimination clauses.* During the performance of this contract the lessee agrees as follows:

(1) The lessee will not discriminate against any employee or applicant for employment because of race, creed, color, or national origin. The lessee will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, creed, color, or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The lessee agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause.

(2) The lessee will, in all solicitations or advertisements for employees placed by or on behalf of the lessee, state that all qualified applicants will receive consideration for employment without regard to race, creed, color, or national origin.

(3) The lessee will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the agency contracting officer, advising the said labor union or workers' representative of the lessee's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The lessee will comply with all provisions of Executive Order No. 10925 of March 6, 1961, as amended, and of the rules, regulations, and relevant orders of the President's Committee on Equal Employment Opportunity created thereby.

(5) The lessee will furnish all information and reports required by Executive Order No. 10925 of March 6, 1961, as amended, and by the rules, regulations, and orders of the said Committee, or pursuant thereto, and will permit access to his books, records, and accounts by the contracting agency and the Committee for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the lessee's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this lease may be cancelled, terminated, or suspended in whole or in part and the lessee may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order No. 10925 of March 6, 1961, as amended, and such other sanctions may be imposed and remedies invoked as provided in the said Executive Order or by rule, regulation, or order of the President's Committee on Equal Employment Opportunity, or as otherwise provided by law.

(7) The lessee will include the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the President's Committee on Equal Employment Opportunity issued pursuant to Section 303 of Executive Order No. 10925 of March 6, 1961, as amended, so that such provisions will be binding upon each subcontractor or vendor. The lessee will take such action with respect to any subcontract or purchase order as the contracting agency may direct as a means of enforcing such provisions, including sanctions for noncompliance: *Provided, however,* that in the event the lessee becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the contracting agency, the lessee may request the United States to enter into such litigation to protect the interests of the United States.

(k) *Land disposed of with coal deposits reserved to the United States.* If the lands embraced herein have been or shall hereafter be disposed of under laws reserving to the United States the deposits of coal therein, to comply with all conditions as are or may hereafter be provided by the laws and regulations reserving such coal.

(l) *Operations, wages, freedom of purchase.* To comply with the appropriate operating regulations, to exercise reasonable diligence, skill, and care in the operations of the property, and to carry on all operations in accordance with approved methods and practices as provided in the operating regulations, having due regard for the prevention of injury to life, health or property, and of waste or damage to any water or mineral deposits; to fairly and justly weigh or measure the coal mined by each miner, to pay all wages due miners and employees, both above and below ground, at least twice each month in lawful money of the United States; to accord all miners and employees complete freedom of purchase; to restrict the workday to not exceeding eight hours in any one day for underground

workers, except in cases of emergency; to employ no boy under the age of sixteen and no girl or woman, without regard to age, in any mine below the surface; unless the laws of the State otherwise provide, in which case the State laws control.

(m) *Taxes.* To pay when due, all taxes lawfully assessed and levied under the laws of the State or the United States upon improvements, output of mines, or other rights, property, or assets of the lessee.

(n) *Overriding royalties.* Not to create, by assignment or otherwise, an overriding royalty interest in excess of 50 percent of the rate of royalty first payable to the United States under this lease or an overriding royalty interest which when added to any other outstanding overriding royalty interest exceeds that percentage, excepting, that where an interest in the leasehold or in an operating agreement is assigned, the assignor may retain an overriding royalty interest in excess of the above limitation if he shows to the satisfaction of the Bureau of Land Management, that he has made substantial investments for improvements on the land covered by the assignment.

(o) *Delivery of premises in case of forfeiture.* In case of forfeiture of this lease, to deliver up to the lessor in good order and condition the land leased, including all buildings, and underground timbering and such other supports and structures as are necessary for the preservation of the mine or deposit.

Sec. 3. The lessor expressly reserves:

(a) *Rights reserved.* The right to permit for joint or several use such easements or rights-of-way, including easements in tunnels upon, through, or in the land leased, occupied, or used as may be necessary or appropriate to the working of the same or other lands containing the deposits described in the Act, and the treatment and shipment of the products thereof by or under authority of the Government, its lessees or permittees, and for other public purposes.

(b) *Disposition of surface.* The right to lease, sell, or otherwise dispose of the surface of the leased lands under existing law or laws hereafter enacted, insofar as said surface is not necessary for the use of the lessee in the extraction and removal of the coal therein, or to dispose of any resource in such lands which will not unreasonably interfere with operations under this lease.

(c) *Monopoly and fair prices.* Full power and authority to promulgate and enforce all the provisions of Section 30 of the Act to insure the sale of the production of said leased lands to the United States and to the public at reasonable prices, to prevent monopoly, and to safeguard the public welfare.

(d) *Readjustment of terms.* The right reasonably to readjust and fix royalties payable hereunder and other terms and conditions at the end of 20 years from the date hereof and thereafter at the end of each succeeding 20-year period during the continuance of this lease unless otherwise provided by law at the time of the expiration of any such period. Unless the lessee files objections to the proposed terms or a relinquishment of the lease within 30 days after receipt of the notice of proposed terms for a 20-year period, he will be deemed to have agreed to such terms.

(e) *Waiver of conditions.* The right to waive any breach of the conditions contained herein, except the breach of such conditions as are required by the Act, but any such waiver shall extend only to the particular breach so waived and shall not limit the rights of the

lessor with respect to any future breach; nor shall the waiver of a particular cause of forfeiture prevent cancellation of this lease for any other cause, or for the same cause occurring at another time.

Sec. 4. *Relinquishment of lease.* Upon a satisfactory showing that the public interest will not be impaired, the lessee may surrender the entire lease or any legal subdivision thereof. A relinquishment must be filed in duplicate in the appropriate Land Office. Upon its acceptance it shall be effective as of the date it is filed, subject to the continued obligation of the lessee and his surety to make payment of all accrued rentals and royalties and to provide for the preservation of any mines or productive works or permanent improvements on the leased lands in accordance with the regulations and terms of the lease.

Sec. 5. *Protection of the surface, natural resources, and improvements.* The lessee agrees to take such reasonable steps as may be needed to prevent operations from unnecessarily: (1) causing or contributing to soil erosion or damaging any forage and timber growth thereon; (2) polluting the waters of springs, streams, wells, or reservoirs; (3) damaging crops, including forage, timber, or improvements of a surface owner; or (4) damaging range improvements whether owned by the United States or by its grazing permittees or lessees; and upon any partial or total relinquishment or the cancellation or expiration of this lease, or at any other time prior thereto when required by the lessor and to the extent deemed necessary by the lessor, to fill any sump holes, ditches and other excavations, remove or cover all debris, and, so far as reasonably possible, restore the surface of the leased land to its former condition, including the removal of structures as and if required. The lessor may prescribe the steps to be taken and restoration to be made with respect to lands of the United States and improvements thereon.

Sec. 6. *Removal of equipment, etc., on termination of lease.* Upon termination of this lease, by surrender or forfeiture, the lessee shall have the privilege at any time within a period of 90 days thereafter of removing from the premises all machinery, equipment, tools and materials, except underground timbering placed by the lessee in or on the leased lands, which are necessary for the preservation of the mine. Any materials, tools, appliances, machinery, structures, and equipment, subject to removal as above provided, which are allowed to remain on the leased lands shall become the property of the lessor on expiration of the 90-day period or such extension thereof as may be granted because of adverse climatic conditions, but the lessee shall remove any or all of such property where so directed by the lessor.

Sec. 7. *Proceedings in case of default.* If the lessee shall not comply with any of the provisions of the Act or the regulations thereunder or default in the performance or observance of any of the provisions of this lease, and such default shall continue for a period of 30 days after service of written notice thereof by the lessor, the lessor may institute appropriate proceedings in a court of competent jurisdiction for the forfeiture and cancellation of this lease as provided in Section 31 of the Act. If the lessee fails to take prompt and necessary steps to prevent loss or damage to the mine, property, or premises, or danger to the employees, the lessor may enter on the premises and take such measures as may be deemed necessary to prevent such loss or damage or to correct the dangerous or unsafe condition of the mine or works thereof, which shall be at the expense of the lessee. However, the lessee shall

not be held responsible for delays or casualties occasioned by causes beyond the lessee's control.

Sec. 8. *Heirs and successors in interest.* Each obligation hereunder shall extend to, and be binding upon, and every benefit hereof shall inure to, the heirs, executors, administrators, successors, or assigns of the respective parties hereto.

Sec. 9. *Unlawful interest.* No Member of, or Delegate to, Congress, or Resident Commissioner, after his

election or appointment, or either before or after he has qualified and during his continuance in office, and no officer, agent, or employee of the Department of the Interior, except as provided in 43 CFR 7.4(a)(1), shall be admitted to any share or part in this lease or derive any benefit that may arise therefrom; and the provisions of section 3741 of the Revised Statutes of the United States, as amended (41 U.S.C. Sec. 22), and sections 431, 432, and 433, Title 18, U.S.C., relating to contracts, enter into and form a part of this lease so far as the same may be applicable.

THE UNITED STATES OF AMERICA

By *Daniel Y. Meschier*
(Signing Officer)

Daniel Y. Meschier
Assistant Manager, Mining
(Title)

WITNESS TO SIGNATURE OF LESSEE

~~XXXXXXXXXXXX~~ AUG 10 1970
(Date)

KERR-McGEE CORPORATION
(Signature of Lessee)

ATTEST:

By:
(Signature of Lessee)
J. C. Finley, Vice President

FORM
APPROVED
DC
LAW DEPT.

Charles G. Dunley
Asst. Secretary

(Signature of Lessee)

(If this lease is executed by a corporation, it must bear the corporate seal)

- (b) Rental. If by the end of the fifth lease year production royalty for any lease year has not equalled or exceeded \$5 an acre, or fraction thereof, the rental for the sixth and each succeeding year shall be increased from \$1 to \$5 an acre, or fraction thereof, until such time as production royalty for any lease year equals or exceeds the latter amount, whereupon the rental shall revert to \$1 an acre, or fraction thereof.

Initial

- (c) Royalty. To pay the lessor a royalty of 17½ cents a ton of 2,000 pounds for the first 10 years of the lease, and 20 cents a ton of 2,000 pounds for the remainder of the first 20-year period succeeding the date of this lease.

Initial

Bind in sum of \$ 75000.00
with Guaranty Co.
as surety filed.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

RECEIVED
AUG 14 1970

W-24710

STIPULATION FOR LANDS UNDER JURISDICTION OF DEPARTMENT OF AGRICULTURE *

The lands embraced in this lease or permit being under the jurisdiction of the Secretary of Agriculture, the lessee or permittee hereby agrees:

(1) To conduct all operations authorized by this lease or permit with due regard for good land management, not to cut or destroy timber without first obtaining permission from the authorized representative of the Secretary of Agriculture, and to pay for all such timber cut or destroyed at the rates prescribed by such representative; to avoid unnecessary damage to improvements, timber, crops, or other cover; unless otherwise authorized by the Secretary of Agriculture, not to drill any well, carry on operations, make excavations, construct tunnels, drill, or otherwise disturb the surface of the lands within 200 feet of any building standing on the lands and whenever required, in writing, by the authorized representative of the Secretary of Agriculture to fence or fill all sump holes, ditches, and other excavations, remove or cover all debris, and so far as reasonably possible, restore the surface of the lands to their former condition, including the removal of structures as and if required, and when required by such representative to bury all pipelines below plow depth.

(2) To do all in his power to prevent and suppress forest, brush, or grass fires on the lands and in their vicinity, and to require his employees, contractors, subcontractors, and employees of contractors or subcontractors to do likewise. Unless prevented by circumstances over which he has no control, the lessee or permittee shall place his employees, contractors, subcontractors, and employees of contractors and subcontractors employed on the lands at the disposal of any authorized officer of the Department of Agriculture for the purpose of fighting forest, brush, or grass fires on or originating on the lands or on adjacent areas or caused by the negligence of the lessee or permittee or his employees, contractors, subcontractors and employees of contractors and subcontractors, with the understanding that payment for such services shall be made at rates to be determined by the authorized representative of the Secretary of

Agriculture, which rates shall not be less than the current rates of pay prevailing in the vicinity for services of a similar character: *Provided*, that if the lessee or permittee, his employees, contractors, subcontractors, or employees of contractors or subcontractors, caused or could have prevented the origin or spread of said fire or fires, no payment shall be made for services so rendered.

During periods of serious fire danger to forest, brush, or grass, as may be specified by the authorized representative of the Secretary of Agriculture, the lessee or permittee shall prohibit smoking and the building of camp and lunch fires by his employees, contractors, subcontractors, and employees of contractors or subcontractors within the area involved except at established camps, and shall enforce this prohibition by all means within his power: *Provided*, that the authorized representative of the Secretary of Agriculture may designate safe places where, after all inflammable material has been cleared away, campfires may be built for the purpose of heating lunches and where, at the option of the lessee or permittee, smoking may be permitted.

The lessee or permittee shall not burn rubbish, trash, or other inflammable materials *except* with the consent of the authorized representative of the Secretary of Agriculture and shall not use explosives in such a manner as to scatter inflammable materials on the surface of the lands during the forest, brush, or grass fire season, *except* as authorized to do so or on areas approved by such representative.

The lessee or permittee shall build or construct such fire lines or do such clearing on the lands as the authorized representative of the Secretary of Agriculture decides is essential for forest, brush, and grass fire prevention which is or may be necessitated by the

* This form of stipulation may be used in connection with leases and permits issued under the Acts of February 25, 1920, as amended (30 U.S.C. 181 *et seq.*); August 7, 1947 (30 U.S.C. 351 *et seq.*); February 7, 1927, as amended (30 U.S.C. 281 *et seq.*); April 17, 1926, as amended (30 U.S.C. 271 *et seq.*); October 20, 1914, as

amended (48 U.S.C. 432 *et seq.*); June 28, 1944 (58 Stat 463 *et seq.*); September 1, 1949 (30 U.S.C. 192c); June 30, 1950 (16 U.S.C. 508b); or under the authority of any of the Acts cited in Section 402 of the President's Reorganization Plan No. 3 of 1946 (5 U.S.C. 133y-16, Note).

exercise of the privileges authorized by this lease or permit, and shall maintain such fire tools at his headquarters or at the appropriate location on the lands as are deemed necessary by such representative.

(3) In the location, design, construction and maintenance of all authorized works, buildings, plants, waterways, roads, telegraph or telephone lines, pipelines, reservoirs, tanks, pumping stations, or other structures or clearance, the lessee or permittee shall do all things reasonably necessary to prevent or reduce to the fullest extent scarring and erosion of the lands, pollution of the water resources and any damage to the watershed. Where construction, operation, or maintenance of any of the facilities on or connected with this lease or permit causes damage to the watershed or pollution of the water resources, the lessee or permittee agrees to repair such damage and to take such corrective measures to prevent further pollution or damage to the watershed as are deemed necessary by the authorized representative of the Secretary of Agriculture.

(4) To pay the lessor or permitter or his tenant or the surface owner or his tenant, as the case may be, for any and all damage to or destruction of property caused by the lessee's or permittee's operations hereunder; to save and hold the lessor or permitter or the surface owner or their tenants harmless from all damage or claims for damage to persons or property resulting from the lessee's or permittee's operations under this lease or permit.

(5) To recognize existing uses and commitments, in the form of Department of Agriculture grazing, timber cutting, and special use permits, water developments, ditch, road, trail, pipeline, telephone line, and fence rights-of-way and other similar improvements, and to conduct his operations so as to interfere as little as possible with the rights and privileges granted by these permits or with other existing uses.

(6) To install and maintain cattle guards to prevent the passage of livestock in any openings made in fences by the lessee or permittee or his contractors to provide access to the lands covered by this lease or permit for automotive and other equipment.

(7) If lessee or permittee shall construct any camp on the lands, such camp shall be located at a place approved by the authorized representative of the Secretary of Agriculture, and such representative shall have authority to require that such camp be kept in a neat and sanitary condition.

(8) To comply with all the rules and regulations of the Secretary of Agriculture governing the national forests or other lands under his jurisdiction which are embraced in this lease or permit.

(9) Unless otherwise authorized, prior to the beginning of operations to appoint and maintain at all times during the term of this lease or permit a local agent upon whom may be served written orders or notices respecting matters contained in this stipulation, and to inform the authorized representative of the Secretary of Agriculture, in writing, of the name and address of such agent. If a substitute agent is appointed, the lessee or permittee shall immediately so inform the said representative.

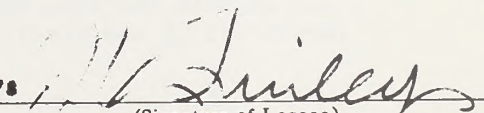
(10) To address all matters relating to this stipulation to

Forest Supervisor
U.S. Forest Service
at Medicine Bow National Forest
Laramie, Wyoming 82070

who is the authorized representative of the Secretary of Agriculture, or to such other representative as may from time to time, be designated, provided that such designation shall be in writing and be delivered to the lessee or permittee or his agent.

(11) If all or any part of the lands lie within a municipal watershed, or are, in the opinion of the authorized representative of the Secretary of Agriculture, primarily valuable for watershed protection, the lessee or permittee shall reseed or otherwise restore the vegetative cover, as required by the authorized representative of the Secretary of Agriculture, for watershed protection and erosion prevention on any areas damaged because of the operation.

KERR-McGEE CORPORATION

By: 
(Signature of Lessee)
J. C. Finley, Vice President

GPO 844-923

SUPPLEMENTAL STIPULATION T
STIPULATION FOR LANDS UNDER JURISDICTION OF DEPARTMENT OF AGRICULTURE

To be attached to and made a part of Form 3103-2.

W-24710

A. Applicable to Exploration Activities

1. At least two weeks before beginning any exploration work, including access and work road location and construction, the lessee shall prepare a "Lessee Exploration Plan" with the District Ranger, ~~Forest Supervisor~~. The plan shall be prepared in triplicate, including maps, for approval by the Forest Supervisor. Such approval will be conditioned on reasonable requirements needed to prevent soil erosion, water pollution, and unnecessary damages to the surface vegetation and other resources of the United States and to provide for the restoration of the land surface and vegetation. The plan shall contain all such provisions as the Forest Service may deem necessary to maintain proper management of the lands and resources within the exploration area.

Where appropriate, depending upon the location and type of operation, the Forest Supervisor may require the plan to contain, at a minimum, the following items:

- (a) The location, construction specifications, maintenance program, and estimated use by the lessee, his employees and agents, of all access and work roads.
- (b) The location and extent of any and all areas to be occupied during the explorations.
- (c) The methods to be used in the explorations, including disposal of waste material.
- (d) The size and type of equipment to be used in the explorations.
- (e) The capacity, size, character, standards of construction and location of all structures and facilities to be constructed.
- (f) Typical profiles of cuts and fills of all areas to be graded for the installation of structures and facilities.
- (g) The location and size of areas upon which vegetation will be destroyed and/or soil laid bare and the steps which will be taken to prevent and control soil erosion thereon, including but not limited to the proposed program for rehabilitation and revegetation of these disturbed lands both during and upon cessation of explorations.
- (h) The steps which will be taken to prevent water pollution.

- (i) The character, amount, and time of use of explosives or fire, including safety precautions which will be taken during their use.
- (j) The coordination and rehabilitation measures that will be taken to protect other uses of the land, permitted livestock, and wildlife.

If later explorations require departures from or additions to the approved plan, these revisions or amendments, together with justification statement for proposed revisions, will be submitted to the District Ranger for approval of the Forest Supervisor.

Any and all operations conducted in advance of approval of an original, revised, or amended exploration plan, or which are not in accord with an approved plan, constitute a violation of the terms of this lease and the Forest Service reserves the right to close down explorations until such corrective action, as is deemed necessary, is taken by the lessee.

2. To guarantee the successful rehabilitation and revegetation of abandoned exploration sites, roads and other disturbed areas, as provided for in the "Lessee Exploration Plan," (paragraph 1) above, the lessee will furnish the Forest Service a surety bond in the amount of \$10,000 prior to undertaking any work on the lease area. Provided that, in the event the work is conducted in separate phases, each phase will be covered by a separate bond in the minimum amount of \$10,000 before the start of any work on each phase. In lieu of surety bond, the lessee may deposit into a Federal Depositary cash, through the Unit Collection Officer, Medicine Park National Forest, or negotiable securities through the Regional Fiscal Agent, U. S. Forest Service, Bldg. 85, Denver Federal Center, Denver, Colorado 80225 in the amounts stated above or each separately bonded phase area. As soon as the lease area has been successfully rehabilitated and revegetated and approved in writing by the Forest Supervisor, surety will be notified, or cash deposits returned with out interest, or securities returned without interest. The lessee agrees that all monies or deposits in lieu thereof, deposited under this authority may be retained by the United States to cover the cost of any said restoration and rehabilitation rendered necessary by failure of the lessee to fulfill all and singular the requirements assumed hereunder without prejudice whatever to any other rights and remedies of the United States.
3. No occupancy of the surface of the following areas is authorized by this lease. The lessee is, however, authorized to emply directional drilling to explore the mineral resources under these areas provided that such drilling or other works will not disturb the surface area or otherwise interfere with their use by the Forest

Service. It is understood and agreed that the use of these areas for National Forest purposes is superior to any other use. The excluded areas are:

- (a) Within the normal highwater line of any and all lakes, ponds, and reservoirs located within the lease area.
- (b) Within 200 feet of the normal highwater line of any and all live streams in the area.
- (c) Within 400 feet of any and all springs and wells within the lease area.
- (d) Within 400 feet of any improvements either owned, permitted, leased, or otherwise authorized by the Forest Service.

The distances in subparagraphs (a), (b), (c), and (d) may be reduced when specifically agreed to in the exploration plan, (paragraph 1).

B. Applicable to Production (operation) Activities

1. The lessee, before the start of any mining operations, agrees to enter into such additional specific stipulations with the Forest Service covering the lessee's mining operations as are deemed necessary and appropriate, depending upon the mining methods to be used and current mining and restoration technology, to meet the following land management principles:

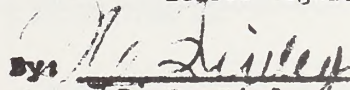
- (a) Maintain and protect the areas which will be either directly or indirectly affected by the lessee's mining operations to minimize the effect on grazing capabilities.
- (b) Install structures and facilities and revegetate disturbed areas to protect the soil from excessive erosion and return the land to a usable condition.
- (c) Take all measures reasonably necessary to minimize the pollution and contamination of the surface and subsurface water sources.
- (d) Protect, insofar as is practicable, improvements owned or authorized by the Forest Service, and restore or replace these said improvements in event they must be destroyed or disturbed by the lessee's mining operations.

Such stipulations will be developed jointly by the lessee; representatives of the Branch of Mining Operations, Conservation Division, U. S. Geological Survey; and the Supervisor,
— Medicine Row —, Forest Service.

2. The lessee shall prepare in triplicate and submit an annual operating plan to the Forest Supervisor which will include as a minimum:
 - (a) The mining operating areas and the methods of operation planned for each area.
 - (b) The areas to be treated and details of the rehabilitation and revegetation measures to be initiated in the planning year to meet the stipulated requirements of the Forest Service.
 - (c) The location and construction specifications of all roads necessary for the mining operation during the planning year.
 - (d) The steps to be taken to minimize water pollution and soil erosion.
 - (e) The correlation of the mining operations with the Forest Service's use and management of the lands not included in that year's operating plan.
3. The lessee shall submit to the Forest Supervisor an annual progress map and report of mining, restoration, and revegetation operations.
4. The lessee shall furnish performance bonds as required by the Forest Supervisor to guarantee fulfillment of the stipulations, entered under (1) above, and the operating plans, prepared under (2) above.
5. The Forest Service reserves the right to amend, alter, or otherwise change during the life of the lease, any and all stipulations necessary to meet the land management principles outlined in paragraph 1 above provided that before any such amendments, alterations, and other changes are made, the lessee shall be invited to make any comments as he may deem necessary and, provided further, that no such amendments, alterations, and changes in these stipulations shall be made unless agreed to in writing by the lessee and the Forest Service.
6. The Forest Service reserves the right to manage and use all lands administered by it which are embraced within the lease for such purposes as they may deem desirable, provided, that this use and management shall not interfere or conflict with the current mining operations of the lessee.

KERR-McGEE CORPORATION

Lessee Signature

By: 
J. C. Finley
Vice President

FORM
APPROVED 
LAW DEPT. 

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

EQUAL OPPORTUNITY IN EMPLOYMENT
CERTIFICATION OF NONSEGREGATED FACILITIES

Bid, offer or contract number or
other identification:

W-24710

By the submission of this bid or offer and/or by entering into this contract, the bidder, offeror, lessee, subcontractor, or applicant certifies that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. He certifies further that he will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The bidder, offeror, applicant, or subcontractor agrees that a breach of this certification is a violation of the Equal Opportunity clause in this contract. As used in this certification, the term "segregated facilities" means, but is not limited to, any waiting rooms, work areas, rest rooms and wash rooms, restaurants and

other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, creed, color, or national origin, because of habit, local custom, or otherwise. He further agrees that (except where he has obtained identical certifications from proposed subcontractors for specific time periods) he will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity clause; that he will retain such certifications in his files; and that he will forward the following notice to such proposed subcontractors (except where the proposed subcontractors have submitted identical certifications for specific time periods):

NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENT
FOR CERTIFICATIONS OF NONSEGREGATED FACILITIES

A Certification of Nonsegregated Facilities, as required by the May 9, 1967, order (32 F.R. 7439, May 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted prior to the award of a subcontract exceeding \$10,000 which is not exempt from the

provisions of the Equal Opportunity clause. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e., quarterly, semiannually, or annually).

In accordance with 41 CFR 60, as amended May 19, 1967, and Executive Order No. 11246 of September 24, 1965, this certification is applicable to all bids, offers, contracts and subcontracts as well as agreements with applicants who are themselves performing federally assisted contracts, which may exceed \$10,000 and are not exempt from the provisions of the Equal Opportunity clause of the Order.

RECEIVED	
UNITED STATES	Bureau of Land Management
DEPARTMENT OF THE INTERIOR	Land Office
BUREAU OF LAND MANAGEMENT	Revenue, Wyoming
COAL LEASE	SEP 3 1965
	11 12 13 14 15 16
	Serial Number
	Wyoming 0313666

This lease, entered into on the 1st day of October, 1965, by the United States of America, the lessor, through the Bureau of Land Management, and Wyodak Resources Development Corporation, P. O. Box 1951, Rapid City, South Dakota, the lessee,

pursuant and subject to the terms and provisions of the Act of February 25, 1920 (41 Stat. 437), as amended, hereinafter referred to as the Act, and to all reasonable regulations of the Secretary of the Interior now or hereafter in force which are made a part hereof,

WITNESSETH:

Sec. 1. *Rights of Lessee.* The lessor, in consideration of the rents and royalties to be paid and the conditions to be observed as hereinafter set forth does hereby grant and lease to the lessee the exclusive right and privilege to mine and dispose of all the coal in the following-described tracts of land, situated in the State of Wyoming

T. 50 N., R. 71 W., 6th Prin. Mer.
Section 9: E $\frac{1}{2}$
Section 10: W $\frac{1}{2}$ NW $\frac{1}{4}$, SW $\frac{1}{4}$
Section 15: W $\frac{1}{2}$ NE $\frac{1}{4}$, W $\frac{1}{2}$, SE $\frac{1}{4}$
Section 21: N $\frac{1}{2}$, N $\frac{1}{2}$ SW $\frac{1}{4}$, SW $\frac{1}{4}$ SW $\frac{1}{4}$, NW $\frac{1}{4}$ SE $\frac{1}{4}$
Section 22: N $\frac{1}{2}$, E $\frac{1}{2}$ SW $\frac{1}{4}$, SE $\frac{1}{4}$
Section 28: NW $\frac{1}{4}$ NW $\frac{1}{4}$

containing 2200 acres, more or less, together with the right to construct all such works, buildings, plants, structures, and appliances as may be necessary and convenient for the mining and preparation of the coal for market, the manufacture of coke or other products of coal, the housing and welfare of employees, and subject to the conditions herein provided, to use so much of the surface as may reasonably be required in the exercise of the rights and privileges herein granted.

Sec. 2. In consideration of the foregoing, the lessee hereby agrees:

(a) *Bond.* To maintain the bond furnished upon the issuance of this lease, which bond is conditioned upon compliance with all the provisions of the lease, and to increase the amount or furnish such other bond as may be required.

(b) *Rental.* To pay the lessor annually, in advance, for each acre or fraction thereof covered by this lease, beginning with the date hereof, the following rentals: 25 cents for the first year; 50 cents for the second, third, fourth, and fifth years, respectively; and \$1 for the sixth and each succeeding year during the continuance of the lease, such rental for any year to be credited against the first royalties as they accrue under the lease during the year for which the rental was paid.

(c) *Royalty.* To pay the lessor a royalty of cents on every ton of 2,000 pounds of coal mined during the first 20 years succeeding the execution of this lease. Royalties shall be payable quarterly within

30 days from the expiration of the quarter in which the coal is mined. For additional royalty terms, see last page.

(d) *Minimum production.* Beginning with the sixth year of the lease, except when operations are interrupted by strikes, the elements, or casualties not attributable to the lessee, or unless on application and showing made, operations shall be suspended when market conditions are such that the lessee cannot operate except at a loss or suspended for the other reasons specified in Section 39 of the Act, to mine coal each year and pay a royalty thereon to a value of \$1 per acre or fraction thereof. Operations under this lease shall be continuous except in circumstances described or unless the lessee shall pay a royalty, less rent, on such minimum amount of the leased deposits, for one year in advance, in which case operations may be suspended for that year.

(e) *Payments.* To make rental payments to the Manager of the appropriate Land Office, except that when this lease becomes productive the rentals and

ORIGINAL

royalties shall be paid to the appropriate regional mining supervisor of the United States Geological Survey, with whom all reports concerning operations under the lease shall be filed. All remittances to the manager of the land office shall be made payable to the Bureau of Land Management, those to the Geological Survey shall be made payable to the United States Geological Survey.

(f) *Plats, reports, maps.* At such times and in such form as the lessor may prescribe, to furnish a plat showing development work and improvements on the leased lands and a report with respect to stockholders, investment, depreciation, and costs. To furnish in such form as the lessor may prescribe, within 30 days from the expiration of each quarter a report covering such quarter, certified by the superintendent of the mine, or by such other agent having personal knowledge of the facts as may be designated by the lessee for such purpose, showing the amount of leased deposits mined during the quarter, the character and quality thereof, amount of its products and byproducts disposed of and price received therefor, and amount in storage or held for sale. To keep and prepare maps of the leased lands in accordance with the appropriate regulations.

(g) *Weights.* To determine accurately the weight or quantity and quality of all leased deposits mined, and to enter accurately the weight or quantity and quality thereof in due form in books to be kept and preserved by the lessee for such purposes.

(h) *Inspection.* To permit at all reasonable times (1) inspection by any duly authorized officer of the Department, of the leased premises and all surface and underground improvements, works, machinery, equipment, and all books and records pertaining to operations and surveys or investigations under this lease, and (2) the lessor to make copies of and extracts from any or all books and records pertaining to operations under this lease, if desired.

(i) *Assignment.* To file for approval in the appropriate land office within 90 days from the date of execution, any assignment or transfer made of this lease, whether by direct assignment, operating agreement, working or royalty interest, or otherwise. Such instrument will take effect the first day of the month following its approval by the Bureau of Land Management, or if the assignee requests, the first day of the month of approval. The showing required to be made with an assignment or transfer is set forth in the appropriate regulations.

(j) *Equal Opportunity clause.* During the performance of this contract the lessee agrees as follows:

(1) The lessee will not discriminate against any employee or applicant for employment because of race, creed, color, or national origin. The lessee will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, creed, color, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The lessee agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause.

(2) The lessee will, in all solicitations or advertisements for employees placed by or on behalf of the lessee, state that all qualified applicants will receive consideration for employment without regard to race, creed, color, or national origin.

(3) The lessee will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the agency contracting officer, advising the labor union or workers' representative of the lessee's commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The lessee will comply with all provisions of Executive Order No. 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(5) The lessee will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the lessee's noncompliance with the nondiscrimination clauses of this contract or with any of such rules, regulations, or orders, this contract may be cancelled, terminated or suspended in whole or in part and the lessee may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The lessee will include the provisions of Paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The lessee will take such action with respect to any subcontract or purchase order as the contracting agency may direct as a means of enforcing such provisions including sanctions for noncompliance: *Provided, however,* That in the event the lessee becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the contracting agency, the lessee may request the United States to enter into such litigation to protect the interest of the United States.

(k) *Land disposed of with coal deposits reserved to the United States.* If the lands embraced herein have been or shall hereafter be disposed of under laws reserving to the United States the deposits of coal therein, to comply with all conditions as are or may hereafter be provided by the laws and regulations reserving such coal.

(l) *Operations, wages, freedom of purchase.* To comply with the appropriate operating regulations, to exercise reasonable diligence, skill, and care in the operations of the property, and to carry on all operations in accordance with approved methods and practices as provided in the operating regulations, having due regard for the prevention of injury to life, health or property, and of waste or damage to any water or mineral deposits; to fairly and justly weigh or measure the coal mined by each miner, to pay all wages due miners and employees, both above and below ground, at least twice each month in lawful money of the United States; to accord all miners and employees complete freedom of purchase; to restrict the workday to not exceeding eight hours in any one day for underground

workers, except in cases of emergency, to employ no boy under the age of sixteen and no girl or woman, without regard to age, in any mine below the surface; unless the laws of the State otherwise provide, in which case the State laws control.

(m) *Taxes.* To pay when due, all taxes lawfully assessed and levied under the laws of the State or the United States upon improvements, output of mines, or other rights, property, or assets of the lessee.

(n) *Overriding royalties.* Not to create, by assignment or otherwise, an overriding royalty interest in excess of 50 percent of the rate of royalty first payable to the United States under this lease or an overriding royalty interest which when added to any other outstanding overriding royalty interest exceeds that percentage, excepting, that where an interest in the leasehold or in an operating agreement is assigned, the assignor may retain an overriding royalty interest in excess of the above limitation if he shows to the satisfaction of the Bureau of Land Management, that he has made substantial investments for improvements on the land covered by the assignment.

(o) *Delivery of premises in case of forfeiture.* In case of forfeiture of this lease, to deliver up to the lessor in good order and condition the land leased, including all buildings, and underground timbering and such other supports and structures as are necessary for the preservation of the mine or deposit.

Sec. 3. The lessor expressly reserves:

(a) *Rights reserved.* The right to permit for joint or several use such easements or rights-of-way, including easements in tunnels upon, through, or in the land leased, occupied, or used as may be necessary or appropriate to the working of the same or other lands containing the deposits described in the act, and the treatment and shipment of the products thereof by or under authority of the Government, its lessees or permittees, and for other public purposes.

(b) *Disposition of surface.* The right to lease, sell, or otherwise dispose of the surface of the leased lands under existing law or laws hereafter enacted, insofar as said surface is not necessary for the use of the lessee in the extraction and removal of the coal therein, or to dispose of any resource in such lands which will not unreasonably interfere with operations under this lease.

(c) *Monopoly and fair prices.* Full power and authority to promulgate and enforce all the provisions of section 30 of the act to insure the sale of the production of said leased lands to the United States and to the public at reasonable prices, to prevent monopoly, and to safeguard the public welfare.

(d) *Readjustment of terms.* The right reasonably to readjust and fix royalties payable hereunder and other terms and conditions at the end of 20 years from the date hereof and thereafter at the end of each succeeding 20-year period during the continuance of this lease unless otherwise provided by law at the time of the expiration of any such period. Unless the lessee files objections to the proposed terms or a relinquishment of the lease within 30 days after receipt of the notice of proposed terms for a 20-year period, he will be deemed to have agreed to such terms.

(e) *Waiver of conditions.* The right to waive any breach of the conditions contained herein, except the breach of such conditions as are required by the act, but any such waiver shall extend only to the particular breach so waived and shall not limit the rights of the

lessor with respect to any future breach, nor shall the waiver of a particular cause of forfeiture prevent cancellation of this lease for any other cause, or for the same cause occurring at another time.

Sec. 4. *Relinquishment of lease.* Upon a satisfactory showing that the public interest will not be impaired, the lessee may surrender the entire lease or any legal subdivision thereof. A relinquishment must be filed in duplicate in the appropriate land office. Upon its acceptance it shall be effective as of the date it is filed, subject to the continued obligation of the lessee and his surety to make payment of all accrued rentals and royalties and to provide for the preservation of any mines or productive works or permanent improvements on the leased lands in accordance with the regulations and terms of the lease.

Sec. 5. *Protection of the surface, natural resources, and improvements.* The lessee agrees to take such reasonable steps as may be needed to prevent operations, including operation of operating plants on the leased premises, from unnecessarily: (1) causing or contributing to soil erosion or damaging any forage and timber growth on the leased lands or on Federal or non-Federal lands in the vicinity; (2) polluting air and water; (3) damaging crops, including forage, timber, or improvements of a surface owner; (4) damaging improvements whether owned by the United States or by its permittees or lessees; or (5) destroying, damaging, or removing fossils, historic or prehistoric ruins, or artifacts; and upon any partial or total relinquishment or the cancellation or expiration of this lease, or at any other time prior thereto when required and to the extent deemed necessary by the lessor to fill any sump holes, ditches, and other excavations, remove or cover all debris, and, so far as reasonably possible, restore the surface of the leased land and access roads to its former condition, including the removal of structures as and if required. The lessor may prescribe the steps to be taken and restoration to be made with respect to the leased lands and improvements thereon, whether or not owned by the United States.

Sec. 6. *Removal of equipment, etc., on termination of lease.* Upon termination of this lease, by surrender or forfeiture, the lessee shall have the privilege at any time within a period of 90 days thereafter of removing from the premises all machinery, equipment, tools and materials, except underground timbering placed by the lessee in or on the leased lands, which are necessary for the preservation of the mine. Any materials, tools, appliances, machinery, structures, and equipment, subject to removal as above provided, which are allowed to remain on the leased lands shall become the property of the lessor on expiration of the 90-day period or such extension thereof as may be granted because of adverse climatic conditions, but the lessee shall remove any or all of such property where so directed by the lessor.

Sec. 7. *Proceedings in case of default.* If the lessee shall not comply with any of the provisions of the act or the regulations thereunder or default in the performance or observance of any of the provisions of this lease, and such default shall continue for a period of 30 days after service of written notice thereof by the lessor, the lessor may institute appropriate proceedings in a court of competent jurisdiction for the forfeiture and cancellation of this lease as provided in section 31 of the act. If the lessee fails to take prompt and necessary steps to prevent loss or damage to the mine, property, or premises, or danger to the employees, the lessor may enter on the premises and take such measures as may be deemed necessary to prevent such loss or damage or to correct the dangerous or unsafe condition of the mine or works thereof, which shall be at the expense of the lessee. However, the lessee shall

not be held responsible for delays or casualties occasioned by causes beyond the lessee's control.

Sec. 8. *Heirs and successors in interest.* Each obligation hereunder shall extend to, and be binding upon, and every benefit hereof shall inure to, the heirs, executors, administrators, successors, or assigns of the respective parties hereto.

Sec. 9. *Unlawful interest.* No Member of, or Delegate to, Congress, or Resident Commissioner, after his

election or appointment, or either before or after he has qualified and during his continuance in office, and officer, agent, or employee of the Department Interior, except as provided in 43 CFR 7.4(a)(1) be admitted to any share or part in this lease or derive any benefit that may arise therefrom; and the provisions of Section 3741 of the Revised Statutes of the United States, as amended (41 U.S.C. Sec. 22), and Sections 431, 432, and 433, Title 18, U.S.C., relating to contracts, enter into and form a part of this lease so far as the same may be applicable.

THE UNITED STATES OF AMERICA

By

George S. Neuberger
(Signature of Officer)

George S. Neuberger
Assistant Manager, Mining

(Title)

September 16, 1965

(Date)

Wyodak Resources Development Corp.

WITNESS TO SIGNATURE OF LESSEE

N. D. Simpson

Secretary-Treasurer

N. D. Simpson

(Signature of Lessee)

Vice President

Harold E. Ross, Vice Pres & Gen Manager

(Signature of Lessee)

(Signature of Lessee)

(If this lease is executed by a corporation, it must bear the corporate seal)

(c) **Royalty.** To pay the lessor a royalty of $17\frac{1}{2}$ cents a ton of 2,000 pounds for the first 10 years of the lease and 20 cents a ton for the remainder of the first 20-year period, succeeding the execution of this lease.

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Initial

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

COAL LEASE
Act of February 25, 1920 (41 Stat. 437) as amended

Land Office

Cheyenne, Wyoming

Serial Number

Wyoming 073289

This lease, entered into on May 1, 1959, by the United States of America, the lessor, through the Bureau of Land Management, and **Wyodak Resources Development Corporation**

**P. O. Box 1951
Rapid City, South Dakota**

the lessee, pursuant and subject to the terms and provisions of the act of February 25, 1920 (41 Stat. 437), as amended, hereinafter referred to as the act, and to all reasonable regulations of the Secretary of the Interior now in force which are made a part hereof.

Witnesseth:

Section 1. *Rights of lessee.* The lessor, in consideration of the rents and royalties to be paid and the conditions to be observed as hereinafter set forth does hereby grant and lease to the lessee the exclusive right and privilege to mine and dispose of all the coal in the following-described tracts of land, situated in the State of **Wyoming**:

**T. 50 N., R. 71 W., 6th P. M.
Section 28: SW $\frac{1}{4}$, W $\frac{1}{2}$ SW $\frac{1}{4}$**

containing **240** acres, more or less, together with the right to construct all such works, buildings, plants, structures, and appliances as may be necessary and convenient for the mining and preparation of the coal for market, the manufacture of coke or other products of coal, the housing and welfare of employees, and, subject to the conditions herein provided, to use so much of the surface as may reasonably be required in the exercise of the rights and privileges herein granted.

Sec. 2. In consideration of the foregoing, the lessee hereby agrees:

(a) *Bond.* To maintain the bond furnished upon the issuance of this lease, which bond is conditioned upon compliance with all the provisions of the lease, and to increase the amount or furnish such other bond as may be required.

(b) *Rental.* To pay the lessor annually, in advance, for each acre or part thereof covered by this lease, beginning with the date hereof, the following rentals: 25 cents for the first year, 50 cents for the second, third, fourth, and fifth years, respectively, and \$1 for the sixth and each succeeding year during the continuance of the lease, such rental for any year to be credited against the first royalties as they accrue under the lease during the year for which the rental was paid.

(c) *Royalty.* To pay the lessor a royalty of _____ cents on every ton of 2,000 pounds of coal mined during the first 20 years succeeding the execution of this lease. Royalties shall be payable quarterly within 30 days from the expiration of the quarter in which the coal is mined.

(d) *Minimum production.* Beginning with the sixth year of the lease, except when operations are interrupted by strikes, _____, payable to the lessee, or _____.

(c) *Royalty.* To pay the lessor a royalty of 10 cents on every ton of 2,000 pounds of coal mined during the first 10 years of the lease; 12½ cents a ton during the next 5 years, and 15 cents a ton during the remainder of the first 20 years succeeding the execution of this lease. Royalties shall be payable quarterly within 30 days from the expiration of the quarter in which the coal is mined.

becomes productive the rentals and royalties shall be paid to the appropriate Regional Mining Supervisor of the United States Geological Survey, with whom all reports concerning operations under the lease shall be filed. All remittances to the Manager of the Land Office shall be made payable to the Bureau of Land Management, those to the Geological Survey shall be made payable to the United States Geological Survey.

(f) *Plats, reports, maps.* At such times and in such form as the lessor may prescribe, to furnish a plat showing development work and improvements on the leased lands and a report with respect to stockholders, investment, depreciation, and costs. To furnish in such form as the lessor may prescribe, within 30 days from the expiration of each quarter a report covering such quarter, certified by the superintendent of the mine, or by such other agent having personal knowledge of the facts as may be designated by the lessee for such purpose, showing the amount of leased deposits mined during the quarter, the character and quality thereof, amount of its products and byproducts disposed of and price received therefor, and amount in storage or held for sale. To keep and prepare maps of the leased lands in accordance with the regulations in 30 CFR, part 211.

(g) *Weights.* To determine accurately the weight or quantity and quality of all leased deposits mined, and to enter

accurately the weight or quantity and quality thereof in due form in books to be kept and preserved by the lessee for such purposes.

(h) *Inspection.* To permit at all reasonable times (1) inspection by any duly authorized officer of the Department, of the leased premises and all surface and underground improvements, works, machinery, equipment, and all books and records pertaining to operations and surveys or investigations under this lease, and (2) the lessor to make copies of and extracts from any or all books and records pertaining to operations under this lease, if desired.

(i) *Assignment.* To file for approval in the appropriate Land Office within 90 days from the date of execution, any assignment or transfer made of this lease, whether by direct assignment, operating agreement, working or royalty interest, or otherwise. Such instrument will take effect the first day of the month following its approval by the Bureau of Land Management, or if the assignee requests, the first day of the month of approval. The showing required to be made with an assignment or transfer is set forth in the regulations, 43 CFR 193.25.

(j) *Nondiscrimination.* In connection with the performance of this lease, the lessee shall not discriminate

subcontracts for standard commercial supplies or raw materials.

(k) *Land disposed of with coal deposits reserved to the United States.* If the lands embraced herein have been or shall hereafter be disposed of under laws reserving to the United States the deposits of coal therein, to comply with all conditions as are or may hereafter be provided by the laws and regulations reserving such coal.

(l) *Operations, wages, freedom of purchase.* To comply with the operating regulations (30 CFR, part 211), to exercise reasonable diligence, skill, and care in the operations of the property, and to carry on all operations in accordance with approved methods and practices as provided in the operating regulations, having due regard for the prevention of injury to life, health or property, and of waste or damage to any water or mineral deposits, to fairly and justly weigh or measure the coal mined by each miner, to pay all wages due miners and employees, both above and below ground, at least twice each month in lawful money of the United States, to accord all miners and employees complete freedom of purchase, to restrict the workday to not exceeding eight hours in any one day for underground workers, except in cases of emergency; to employ no boy under the age of sixteen and no girl or woman,

without regard to age, in any mine below the surface, unless the laws of the State otherwise provide, in which case the State laws control.

(m) *Taxes.* To pay when due, all taxes lawfully assessed and levied under the laws of the State or the United States upon improvements, output of mines, or other rights, property, or assets of the lessee.

(n) *Overriding royalties.* Not to create, by assignment or otherwise, an overriding royalty interest in excess of 50 percent of the rate of royalty first payable to the United States under this lease or an overriding royalty interest which when added to any other outstanding overriding royalty interest exceeds that percentage, excepting, that where an interest in the leasehold or in an operating agreement is assigned, the assignor may retain an overriding royalty interest in excess of the above limitation if he shows to the satisfaction of the Bureau of Land Management, that he has made substantial investments for improvements on the land covered by the assignment.

(o) *Delivery of premises in case of forfeiture.* In case of forfeiture of this lease, to deliver up to the lessor in good order and condition the land leased, including all buildings, and underground timbering and such other supports and structures, as are necessary for the preservation of the mine or deposit.

Sec. 3. The lessor expressly reserves:

(a) *Rights reserved.* The right to permit for joint or several use such easements or rights-of-way, including easements in tunnels upon, through, or in the land leased, occupied, or used as may be necessary or appropriate to the working of the same or other lands containing the deposits described in the act, and the treatment and shipment of the products thereof by or under authority of the Government, its lessees or permittees, and for other public purposes.

(b) *Disposition of surface.* The right to lease, sell, or otherwise dispose of the surface of the leased lands under existing law or laws hereafter enacted, insofar as said surface is not necessary for the use of the lessee in the extraction and removal of the coal therein, or to dispose of any resource in such lands which will not unreasonably interfere with operations under this lease.

(c) *Monopoly and fair prices.* Full power and authority to promulgate and enforce all the provisions of section 30 of the act to insure the sale of the production of said leased lands to the United States and to the public at reasonable prices, to prevent monopoly, and to safeguard the public welfare.

(d) *Readjustment of terms.* The right reasonably to readjust and fix royalties payable hereunder and other terms and conditions at the end of 20 years from the date hereof and thereafter at the end of each succeeding 20-year period during the continuance of this lease unless otherwise provided by law at the time of the expiration of any such period. Unless the lessee files objections to the proposed terms or a relinquishment of the lease within 30 days after receipt of the notice of proposed terms for a 20-year period, he will be deemed to have agreed to such terms.

(e) *Waiver of conditions.* The right to waive any breach of the conditions contained herein, except the breach of such conditions as are required by the act, but any such waiver shall extend only to the particular breach so waived and shall not limit the rights of the lessor with respect to any future breach; nor shall the waiver of a particular cause of forfeiture prevent cancellation of this lease for any other cause, or for the same cause occurring at another time.

Sec. 4. Relinquishment of lease. Upon a satisfactory showing that the public interest will not be impaired, the lessee may surrender the entire lease or any legal subdivision thereof. A relinquishment must be filed in duplicate in the appropriate Land Office. Upon its acceptance it shall be effective as of the date it is filed, subject to the continued obligation of the lessee and his surety to make payment of all accrued rentals and royalties and to provide for the preservation of any mines or productive works or permanent improve-

ments on the leased lands in accordance with the regulations and terms of the lease.

Sec. 5. Protection of the surface, natural resources, and improvements. The lessee agrees to take such reasonable steps as may be needed to prevent operations from unnecessarily: (1) Causing or contributing to soil erosion or damaging any forage and timber growth thereon; (2) polluting the waters of springs, streams, wells, or reservoirs; (3) damaging crops, including forage, timber, or improvements of a surface owner; or (4) damaging range improvements whether owned by the United States or by its grazing permittees or lessees; and upon any partial or total relinquishment or the cancellation or expiration of this lease, or at any other time prior thereto when required by the lessor and to the extent deemed necessary by the lessor, to fill any sump holes, ditches and other excavations, remove or cover all debris, and, so far as reasonably possible, restore the surface of the leased land to its former condition, including the removal of structures as and if required. The lessor may prescribe the steps to be taken and restoration to be made with respect to lands of the United States and improvements thereon.

Sec. 6. Removal of equipment, etc., on termination of lease. Upon termination of this lease, by surrender or forfeiture, the lessee shall have the privilege at any time within a period of 90 days thereafter of removing from the premises all machinery, equipment, tools and materials, other than underground timbering placed by the lessee in or on the leased lands, which are not necessary for the preservation of the mine. Any materials, tools, appliances, machinery, structures, and equipment, subject to removal as above provided, which are allowed to remain on the leased lands shall become the property of the lessor on expiration of the 90-day period or such extension thereof as may be granted because of adverse climatic conditions, but the lessee shall remove any or all of such property where so directed by the lessor.

Sec. 7. Proceedings in case of default. If the lessee shall not comply with any of the provisions of the act or the regulations thereunder or default in the performance or observance of any of the provisions of this lease, and such default shall continue for a period of 30 days after service of written notice thereof by the lessor, the lessor may institute appropriate proceedings in a court of competent jurisdiction for the forfeiture and cancellation of this lease as provided in section 31 of the act (30 USC, sec. 188). If the lessee fails to take prompt and necessary steps to prevent loss or damage to the mine, property, or premises, or danger to the employees, the lessor may enter on the premises and take such measures as may be deemed necessary to prevent such loss or damage or to correct the dangerous or unsafe condition of the mine or works thereof, which shall be at the expense of the lessee. However, the lessee shall not be held responsible for delays or casualties occasioned by causes beyond the lessee's control.

Sec. 8. Heirs and successors in interest. Each obligation hereunder shall extend to, and be binding upon, and every benefit hereof shall inure to, the heirs, executors, administrators, successors, or assigns of the respective parties hereto.

Sec. 9. Unlawful interest. No Member of, or Delegate to, Congress or Resident Commissioner, after his election or appointment, or either before or after he has qualified and during his continuance in office, and no officer, agent, or employee of the Department of the Interior, except as provided in 43 CFR 7.4(a)(1), shall be admitted to any share or part in this lease or derive any benefit that may arise therefrom, and the provisions of section 3741 of the Revised Statutes of the United States, as amended (41 USC, sec. 22), and sections 431, 432, and 433, title 18, U. S. Code, relating to contracts, enter into and form a part of this lease so far as the same may be applicable.

IN WITNESS WHEREOF:

THE UNITED STATES OF AMERICA

By *Craig A. Decker* (Signature of) Manager, Land Office
Bureau of Land Management, Cheyenne, Wyoming

WITNESSES TO SIGNATURE OF LESSEE

[Signature]

WYODAK RESOURCES DEVELOPMENT CORP. (Inc.)

[Signature]
(Signature of Lessee)

(Signature of Lessee)

(Signature of Lessee)

(If this lease is executed by a corporation, it must bear the corporate seal)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

COAL LEASE
Act of February 25, 1920 (41 Stat. 437), as amended

Land Office

Cheyenne, Wyoming

Serial Number

Wyoming 0111833

This lease, entered into on April 1, 1961, by the United States of America, the lessor, through the Bureau of Land Management, and Wyodak Resources Development Corp. P. O. Box 149, Gillette, Wyoming

the lessee, pursuant and subject to the terms and provisions of the act of February 25, 1920 (41 Stat. 437), as amended, hereinafter referred to as the act, and to all reasonable regulations of the Secretary of the Interior now in force which are made a part hereof,

Witnesseth:

Section 1. *Rights of lessee.* The lessor, in consideration of the rents and royalties to be paid and the conditions to be observed as hereinafter set forth does hereby grant and lease to the lessee the exclusive right and privilege to mine and dispose of all the coal in the following-described tracts of land, situated in the State of Wyoming:

T. 50 N., R. 71 W., 6th P. M.
Sec. 21: SE $\frac{1}{4}$ SE $\frac{1}{4}$,
Sec. 22: SW $\frac{1}{4}$ SW $\frac{1}{4}$.

containing 80 acres, more or less, together with the right to construct all such works, buildings, plants, structures, and appliances as may be necessary and convenient for the mining and preparation of the coal for market, the manufacture of coke or other products of coal, the housing and welfare of employees, and, subject to the conditions herein provided, to use so much of the surface as may reasonably be required in the exercise of the rights and privileges herein granted.

Sec. 2. In consideration of the foregoing, the lessee hereby agrees:

(a) *Bond.* To maintain the bond furnished upon the issuance of this lease, which bond is conditioned upon compliance with all the provisions of the lease, and to increase the amount or furnish such other bond as may be required.

(b) *Rental.* To pay the lessor annually, in advance, for each acre or part thereof covered by this lease, beginning with the date hereof, the following rentals: 25 cents for the first year, 50 cents for the second, third, fourth, and fifth years, respectively, and \$1 for the sixth and each succeeding year during the continuance of the lease, such rental for any year to be credited against the first royalties as they accrue

accurately the weight or quantity and quality thereof in due form in books to be kept and preserved by the lessee for such purposes.

(h) *Inspection.* To permit at all reasonable times (1) inspection by any duly authorized officer of the Department, of the leased premises and all surface and underground improvements, works, machinery, equipment, and all books and records pertaining to operations and surveys or investigations under this lease; and (2) the lessor to make copies of and extracts from any or all books and records pertaining to operations under this lease, if desired.

(i) *Assignment.* To file for approval in the appropriate Land Office within 90 days from the date of execution, any

(c) *Royalty.* To pay the lessor a royalty of 10 cents on every ton of 2,000 pounds of coal mined during the first 5 years of the lease; 12 $\frac{1}{2}$ cents a ton during the next 5 years, and 15 cents a ton during the remainder of the first 20-year period of the lease. Royalties shall be payable quarterly within 30 days from the expiration of the quarter in which the coal is mined.

reasons specified in section 39 of the act, to mine coal each year and pay a royalty thereon to a value of \$1 per acre or fraction thereof. Operations under this lease shall be continuous except in the circumstances described or unless the lessee shall pay a royalty, less rent, on such minimum amount of the leased deposits, for one year in advance, in which case operations may be suspended for that year.

(e) *Payments.* To make rental payments to the Manager of the appropriate Land Office, except that when this lease becomes productive the rentals and royalties shall be paid to the appropriate Regional Mining Supervisor of the United States Geological Survey, with whom all reports concerning operations under the lease shall be filed. All remittances to the Manager of the Land Office shall be made payable to the Bureau of Land Management, those to the Geological Survey shall be made payable to the United States Geological Survey.

(f) *Plats, reports, maps.* At such times and in such form as the lessor may prescribe, to furnish a plat showing development work and improvements on the leased lands and a report with respect to stockholders, investment, depreciation, and costs. To furnish in such form as the lessor may prescribe, within 30 days from the expiration of each quarter a report covering such quarter, certified by the superintendent of the mine, or by such other agent having personal knowledge of the facts as may be designated by the lessee for such purpose, showing the amount of leased deposits mined during the quarter, the character and quality thereof, amount of its products and byproducts disposed of and price received therefor, and amount in storage or held for sale. To keep and prepare maps of the leased lands in accordance with the regulations in 30 CFR, part 211.

(g) *Weights.* To determine accurately the weight or quantity and quality of all leased deposits mined, and to enter

therein a provision which shall be as follows: Employment, upgrading, demotion, or transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship. The lessee also agrees to post hereafter in conspicuous places, available for employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of the nondiscrimination clause. The lessee further agrees to insert the foregoing provision in all subcontracts hereunder, except subcontracts for standard commercial supplies or raw materials.

(k) *Land disposed of with coal deposits reserved to the United States.* If the lands embraced herein have been or shall hereafter be disposed of under laws reserving to the United States the deposits of coal therein, to comply with all conditions as are or may hereafter be provided by the laws and regulations reserving such coal.

(l) *Operations, wages, freedom of purchase.* To comply with the operating regulations (30 CFR, part 211), to exercise reasonable diligence, skill, and care in the operations of the property, and to carry on all operations in accordance with approved methods and practices as provided in the operating regulations, having due regard for the prevention of injury to life, health or property, and of waste or damage to any water or mineral deposits; to fairly and justly weigh or measure the coal mined by each miner, to pay all wages due miners and employees, both above and below ground, at least twice each month in lawful money of the United States; to accord all miners and employees complete freedom of purchase; to restrict the workday to not exceeding eight hours in any one day for underground workers, except in cases of emergency; to employ no boy under the age of sixteen and no girl or woman,

without regard to age, in any mine with the surface, unless the laws of the State otherwise provide, in which case the State laws control.

(m) *Taxes.* To pay when due, all taxes lawfully assessed and levied under the laws of the State or the United States upon improvements, output of mines, or other rights, property, or assets of the lessee.

(n) *Overriding royalties.* Not to create, by assignment or otherwise, an overriding royalty interest in excess of 50 percent of the rate of royalty first payable to the United States under this lease or an overriding royalty interest which when added to any other outstanding overriding royalty interest exceeds that percentage, excepting, that where an interest in the leasehold or in an operating agreement is assigned, the assignor may retain an overriding royalty interest in excess of the above limitation if he shows to the satisfaction of the Bureau of Land Management, that he has made substantial investments for improvements on the land covered by the assignment.

(o) *Delivery of premises in case of forfeiture.* In case of forfeiture of this lease, to deliver up to the lessor in good order and condition the land leased, including all buildings, and underground timbering and such other supports and structures as are necessary for the preservation of the mine or deposit.

Sec. 3. The lessor expressly reserves:

(a) *Rights reserved.* The right to permit for joint or several use such easements or rights-of-way, including easements in tunnels upon, through, or in the land leased, occupied, or used as may be necessary or appropriate to the working of the same or other lands containing the deposits described in the act, and the treatment and shipment of the products thereof by or under authority of the Government, its lessees or permittees, and for other public purposes.

(b) *Disposition of surface.* The right to lease, sell, or otherwise dispose of the surface of the leased lands under existing law or laws hereafter enacted, insofar as said surface is not necessary for the use of the lessee in the extraction and removal of the coal therein, or to dispose of any resource in such lands which will not unreasonably interfere with operations under this lease.

(c) *Monopoly and fair prices.* Full power and authority to promulgate and enforce all the provisions of section 30 of the act to insure the sale of the production of said leased lands to the United States and to the public at reasonable prices, to prevent monopoly, and to safeguard the public welfare.

(d) *Readjustment of terms.* The right reasonably to readjust and fix royalties payable hereunder and other terms and conditions at the end of 20 years from the date hereof and thereafter at the end of each succeeding 20-year period during the continuance of this lease unless otherwise provided by law at the time of the expiration of any such period. Unless the lessee files objections to the proposed terms or a relinquishment of the lease within 30 days after receipt of the notice of proposed terms for a 20-year period, he will be deemed to have agreed to such terms.

(e) *Waiver of conditions.* The right to waive any breach of the conditions contained herein, except the breach of such conditions as are required by the act, but any such waiver shall extend only to the particular breach so waived and shall not limit the rights of the lessor with respect to any future breach; nor shall the waiver of a particular cause of forfeiture prevent cancellation of this lease for any other cause, or for the same cause occurring at another time.

Sec. 4. Relinquishment of lease. Upon a satisfactory showing that the public interest will not be impaired, the lessee may surrender the entire lease or any legal subdivision thereof. A relinquishment must be filed in duplicate in the appropriate Land Office. Upon its acceptance it shall be effective as of the date it is filed, subject to the continued obligation of the lessee and his surety to make payment of all accrued rentals and royalties and to provide for the preservation of any mines or productive works or permanent improve-

ments on the leased lands in accordance with the regulations and terms of the lease.

Sec. 5. Protection of the surface, natural resources, and improvements. The lessee agrees to take such reasonable steps as may be needed to prevent operations from unnecessarily: (1) Causing or contributing to soil erosion or damaging any forage and timber growth thereon; (2) polluting the waters of springs, streams, wells, or reservoirs; (3) damaging crops, including forage, timber, or improvements of a surface owner, or (4) damaging range improvements whether owned by the United States or by its grazing permittees or lessees; and upon any partial or total relinquishment or the cancellation or expiration of this lease, or at any other time prior thereto when required by the lessor and to the extent deemed necessary by the lessor, to fill any sump holes, ditches and other excavations, remove or cover all debris, and, so far as reasonably possible, restore the surface of the leased land to its former condition, including the removal of structures as and if required. The lessor may prescribe the steps to be taken and restoration to be made with respect to lands of the United States and improvements thereon.

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Sec. 7. Proceedings in case of default. If the lessee shall not comply with any of the provisions of the act or the regulations thereunder or default in the performance or observance of any of the provisions of this lease, and such default shall continue for a period of 30 days after service of written notice thereof by the lessor, the lessor may institute appropriate proceedings in a court of competent jurisdiction for the forfeiture and cancellation of this lease as provided in section 31 of the act (30 USC, sec. 188). If the lessee fails to take prompt and necessary steps to prevent loss or damage to the mine, property, or premises, or danger to the employees, the lessor may enter on the premises and take such measures as may be deemed necessary to prevent such loss or damage or to correct the dangerous or unsafe condition of the mine or works thereof, which shall be at the expense of the lessee. However, the lessee shall not be held responsible for delays or casualties occasioned by causes beyond the lessee's control.

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IN WITNESS WHEREOF:

THE UNITED STATES OF AMERICA

By *Walter H. Hall*
(Signing Officer)
Manager, Land Office, Bureau of Land
Management, Cheyenne, Wyoming 3-27-61.

WITNESSES TO SIGNATURE OF LESSEE

John P. Antosh
Secretary

WYODAK RESOURCES DEVELOPMENT CORP.
Neil D. Simpson
(Signature of Lessee) Vice President

(Signature of Lessee)

(Signature of Lessee)

If this lease is executed by a corporation, it must bear the corporate seal)

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(June 1984)

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